ELECTRICAL REVIEW

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Engineering Training

Equality of Opportunity

NO subject more important in its ultimate bearings is likely to be tackled by the I.E.E. Post-War Planning Committee than that of education and training for engineers. The report issued this week, as was to be expected, is in close accord with the views expressed in the well-thought-out paper presented before the Institution fourteen months ago by Dr. A. P. M. Fleming, who is chairman of the sub-committee now responsible, and takes account of points raised during the subsequent two-evening discussion.

True Education

The recommendations made are set out on a later page. Certain broad principles stand out, the first of which is the sub-ordination of the pursuit of knowledge as such to the development of individual intelligence so that it may make use of whatever knowledge it can fully assimilate.

Again and again such phrases occur as the need " to awaken the critical faculty " and " to stimulate independent and critical thought and action " and references are made to the value of corporate life in the schools and the use of leisure for independent reading and thinking. The last provides one reason in favour of part-time day schools as against evening classes.

The second notable feature is the dictum that lack of financial resources ought not to keep higher education from those able to profit by it. This " equality of opportunity for all " is not only an expression of a sound democratic principle ; it is essential on strictly practical grounds since, with the accelerating expansion of engineering, provision for leadership must be made on the broadest possible basis.

Another proposal of importance relates to limitation of entry into engineering—not arbitrarily, but through a closer collaboration between schools and industry for the purpose of helping students to choose the most appropriate careers and by allowing a probationary period at the beginning of apprenticeship. Since few engineers are likely to be engaged later in the more highly scientific work, it will probably be widely accepted that much of the time now spent on advanced technical subjects would, in the majority of cases, be better devoted to other matters more useful in later life.

Foremen and Craftsmen

It is not enough that those destined for the more responsible positions should be adequately trained. Their work can be really fruitful only if supported by that of foremen and craftsmen who are also trained to develop initiative within their own sphere of usefulness, and the Institution's scheme would have been incomplete if it had not covered their needs as well.

There remains what is perhaps the most difficult aspect of the whole, but on it the full success of any training proposals will largely depend. That is the question of the training of the teachers themselves. Not only the technical side is involved, because the influence of elementary general education cannot be ignored. Much could be done, however, if those who give technical

instruction were encouraged to keep more closely in touch with workshop practice and if teaching were made financially attractive to engineers from the higher ranks of industry. The present recommendations will no doubt receive the careful consideration of the Board of Education. They will cost money to implement, but can there be any long-term investment that is likely to yield a higher dividend?

Gas Development

PROPOSALS are afoot in the gas industry to strengthen its development organisation. Under these the National Gas Council and the British Commercial Gas Association would be merged and the new structure would involve the setting up of eleven district committees which would nominate delegates to a central council upon which the Institution of Gas Engineers and the Society of British Gas Industry would also be represented. The chairman of the council would have a limited tenure of office and there would be a permanent general manager or director. Having in mind the present search by E.D.A. for a new director, it is of interest to note a statement by the President of the Institution of Gas Engineers that "the necessity to fill that post adequately by the appointment of a man of outstanding ability and one capable of performing effectively the difficult tasks that would fall to him is a matter of supreme importance."

Analogy

IT is often easier to understand electrical phenomena if they can be illustrated by mechanical effects that have points of similarity. The correspondence may not always be complete, but the method serves its broad purpose. On the other hand, problems in mechanics may often be worked out exactly by translating them into mathematically equivalent electric circuits. A number of good examples of such conversions are given in the chairman's address to the I.E.E. Sheffield Sub-Centre (*I.E.E. Journal* for March) by Dr. A. W. Ashton, who writes from experience gained in training engineering students.

Lightning

MOST of the investigations into the effects of lightning have related to overhead communication and power transmission lines and associated electrical apparatus. A reminder of the importance of lightning protection in regard to structures was given by Mr. J. F. Shipley in his I.E.E. Transmission Section paper last week, which was a useful summary of the present stage of development and amplified the Code of Practice recently issued by the Ministry of Works and Planning. More exact knowledge of the vagaries of lightning and further experience in the application of protection are clearly still needed. The discussion of the paper revealed differences in opinion as to the application of approved methods, notably in regard to the question of whether the lightning conductor should be bonded to other metal in the building or isolated from it.

Coal Research

AN expenditure of several million pounds per annum and the employment of hundreds of thousands of research workers is proposed by the Parliamentary and Scientific Committee in a report on the proper utilisation of our coal resources. One suggestion is that there should be a complete power station for the carrying out of research into the generation of electricity. The idea is an attractive one, but fully executed would probably involve a colossal expenditure. There is much merit in the present method of installing new types of boiler in new or extended public service stations. Perhaps improved facilities for the interchange of information would enhance the value of the system and maybe financial assistance could be afforded to "experimenting" undertakings.

Water-Power and Coal

ALTHOUGH our country is normally an exporter of coal it is apparent that with the rapid growth of power needs conservation of our resources will be an important consideration after the war. As an illustration of the saving in coal consumption which hydro-electric development represents, some figures given in the latest survey of the Canadian Water and Power Bureau are of interest. It is estimated that each hydraulic horse-power, if operated continuously throughout the year, would effect a saving of about 4½ tons of coal, so that the Dominion's present water-power plant is capable of saving 41 million tons of coal annually. The actual saving in 1942 is estimated at 25 million tons. Without the use of water power it would have been necessary to double the imports of coal last year.

Music in the Factory

A Large Installation with Remote Control of One Section

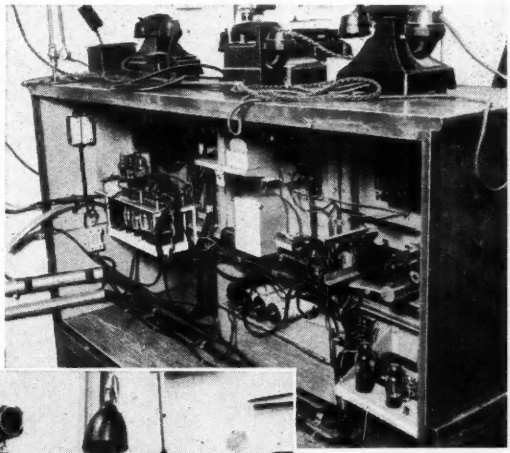
THE system described in this article, installed in a large factory, was initially designed to handle time and A.R.P. signals, but it has since been modified progressively to cope with the demands for public address facilities and "Music While You Work." The result is that, despite the particularly rapid advance in the design and lay-out of such systems in the past couple of years, this scheme is quite up to date generally and possesses a number of unusual features.

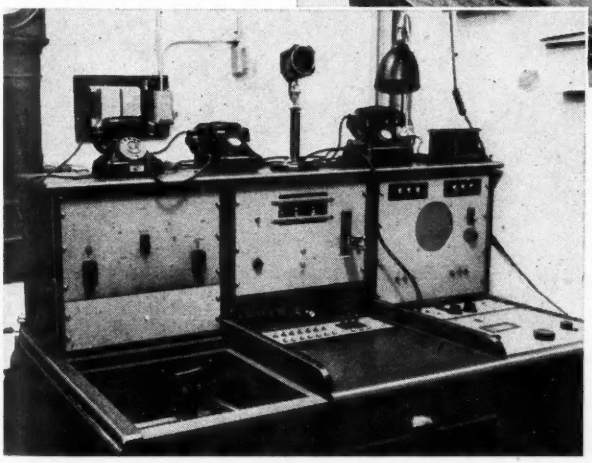
The installation is in two major parts, one at a main works where the amplifying equipment has direct connections for all circuits to the nearby control and transmitting room, and one at a subsidiary factory some distance away where there are amplifiers to which all the transmission for both signals and switching from the main works control room is effected over one pair of Post Office lines.

For the sake of clarity we propose to deal with the two parts separately, the main factory one first, bearing in mind that a good deal of the control equipment is common to both sections. The control board, which is housed in a separate transmitting room, is in the form of a desk, this being the main alteration to the scheme when the amplification and the control equipments for the main works were separated. It is a wooden structure made by the factory pattern department, with three equipment cabinets and three horizontal and three vertical control panels.

The principal items in the main equipment cabinet at the back are two pre-amplifiers by which master volume control for the whole installation is effected and initial signals are amplified; an oscillator and a synchronous motor-driven drum-type switch for the works warning system; and a buffer amplifier used in connection with the remotely controlled section of the installation.

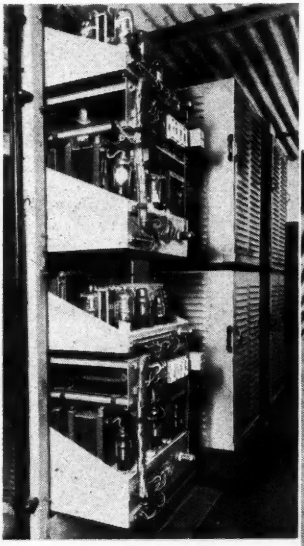
In the two side cabinets at the front of the desk are an eight-record automatic electric

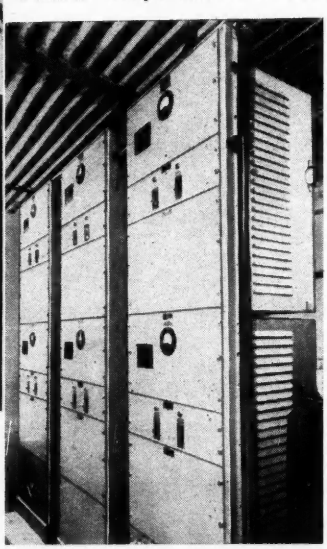




The desk-type control board has three equipment cabinets and three horizontal and three vertical control panels, and the principal items in the main cabinet are two pre-amplifiers (left), a motor-driven drum-type switch serving the warning-signal oscillator (centre) and a buffer amplifier (right)

gramophone and pick-up on the left and a normal radio receiver on the right, which, with the transmitting-room microphone, constitute the three normal signal sources of the system. On the centre horizontal panel are selector switches governing these three signal sources, as well as six amplifier switches in the HT circuits of the main works amplifiers and a master switch for the control of all these amplifier switches.





Each amplifier unit of the three two-amplifier racks at the main works is in three sections; 180-W amplifier, top; switch section, centre; and power pack, bottom

On the right horizontal panel are a change-over switch controlling the pre-amplifiers, providing for instant change-over in the case of breakdown, and two master volume controls, as well as the sockets for the plug-in table-type moving-coil microphone. The right vertical panel constitutes an amplifier testing unit comprising a monitor loudspeaker and six switches by which this is brought into circuit with any of the main works amplifiers, so that the control officer can test the quality of broadcasting to any part of the works. Six neon lamps also on this panel provide a rough indication of the amplifier output levels. The left vertical panel serves the remote control scheme, and the central vertical panel contains the key for the time signals and the air-raid warning control pushes for the three-valve oscillator which produces the note for these signals. The pushes operate the small motor which is directly coupled to the drum switch with contacts which make and break the oscillator circuit.

The main works amplifier equipment is housed in a separate room and consists of three racks each accommodating two amplifier units. Each of these units is made up of three sections, the 180-W amplifier proper at the top, the switch and power control section at the centre and the power pack at the bottom, each with its appropriate front panel.

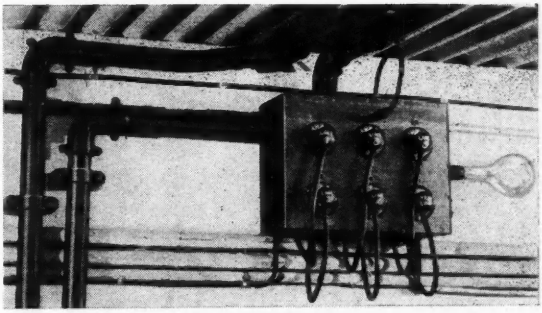
Each of the amplifiers serves about 30 loudspeakers in a particular section of the factory. Amplification is in three stages. The signal from the control desk pre-amplifier is fed into a single valve. The second stage consists of two valves in push-pull which feed the third stage, a pair of medium power valves. These form the driver stage for the two large power valves which operate in a zero-bias "Class B" output stage. Main audio gain (volume) control is fitted on the front panel, together with a 0–500 mA meter which indicates the total anode current of the two output valves.

The intermediate and output stages are served at 300 V and 1,000 V, respectively, by separate HT transformers in the power pack which also includes two mercury-vapour rectifiers with delayed operation for the power output stage and normal valve rectification for the early stages. The switch control section contains two switches for the HT and LT supplies and a pilot light, and incorporates a thermal delay unit (about 40 seconds) which allows the mercury vapour rectifier valve filaments to heat up before the load is applied, thus ensuring that these valves are in full operating condition before the application of the high voltage.

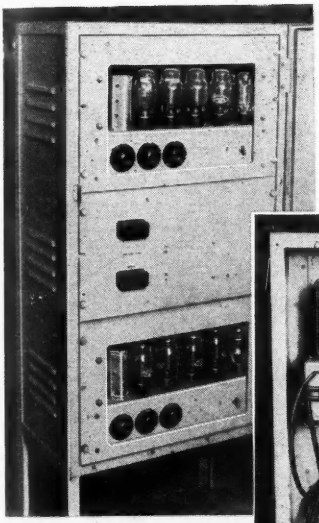
At the bottom of the left rack is a testing loudspeaker for use by the maintenance engineer. Relays at the bottom of the central rack are operated from the control desk, being part of the control system between the control room and the amplifiers. A panel at the bottom of the right rack accommodates a

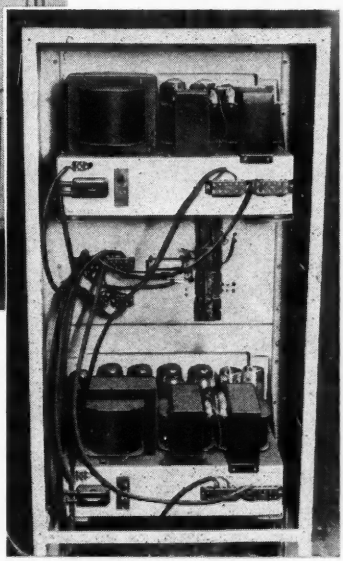
separate pair of fuses for each amplifier.

The lines from the amplifiers to the various speaker circuits in the main factory are taken *via* a plug and socket interchange board in the amplifier room, by which any circuit can be connected at will to any of the amplifiers. The board also serves as a line testing point for the circuits, and there are arrangements for plugging in a dummy test load of predetermined resistance on to any amplifier to avoid passing on test signals to the works. Between the control board and the amplifiers the cabling is t.r.s. in screwed conduit, while throughout the factory the loudspeaker circuit cabling is t.r.s. cleated to various building members. The mains



By means of a plug and socket board any loudspeaker circuit can be connected to any amplifier





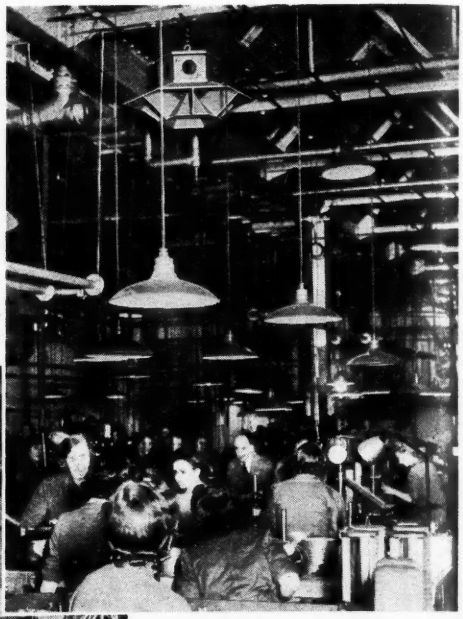
On each of the twin-amplifier sets at the distant factory there are two amplifier sections proper and a remote line termination panel (centre)

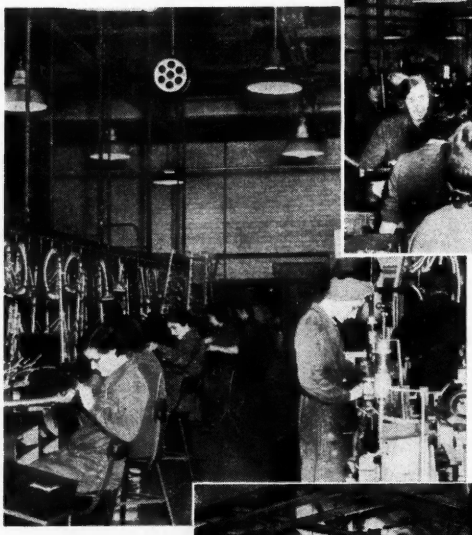
are 7/·029 and the subsidiaries 3/·029 cables. All the loudspeakers in the main offices where music is not required are connected on a "dead" line which is only brought into circuit for A.R.P. warnings, time signals and announcements.

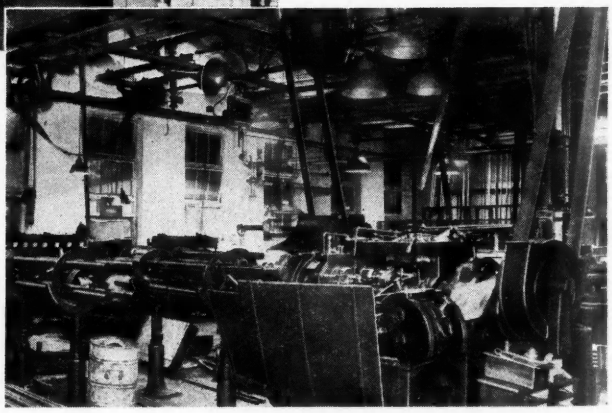
Under normal conditions the entire main factory is operated from a mains (public) supply. For emergency use, however, an alternative supply is available from a three-kVA 1,000-RPM alternator directly driven by a 10-HP Standard automobile petrol engine. The alternator is separately excited by a small unit which sits on the alternator frame and is belt-driven from the alternator shaft. The link between the normal and emergency supplies is provided by a change-over switch situated on the wall of the control room near the desk. The equipment at the distant factory is also on mains supply, but in this case the intake is direct to each amplifier unit—not from the control room. The HT switching, however, is effected from the control desk over the one pair of P.O. lines and the signals are superimposed on the same lines by means of the buffer amplifier in the control desk. Inasmuch as the control board and the amplifiers at the main works are entirely separated one may say that these amplifiers are also remotely controlled, but the superimposition scheme provided for the distant factory gives remote control in this case a special significance.

To make things quite clear before we refer to the actual equipment at the distant factory, the sequence of transmission from the control board is: from the pre-amplifier, through the buffer amplifier, over the P.O. lines to the remote control termination panel on each distant amplifier and then to the actual amplifiers and on to the loudspeakers.

There are two twin-amplifier sets at the distant works and each 60-W amplifier of each set serves one circuit of about ten loudspeakers, while a third set has just one 180-W amplifier serving about 20 speakers. On each of the smaller sets there are just the two amplifier sections proper and a remote line termination panel, whereas the large set comprises the amplifier section proper, the switch section and the power pack at the centre, as well as the remote line termination panel and a test panel at the top and bottom, respectively. Thus the centre portion is identical with each of the complete single amplifier equipments at the main works. The







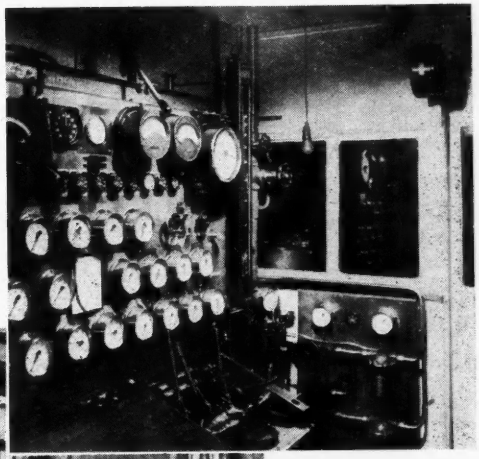
Top: Where the main problem is to "cover" a large area the diffuser-type of speaker is employed

Centre: A fairly quiet shop with about 60 operatives mainly on assembly work is served by one industrial "Senior" loudspeaker

Bottom: In noisy situations the horn-type speaker is given first place (machine shop with compromise scheme)

difference between the make-up of the large and small sets at the distant factory is explained by the fact that whereas the large set has both 300-V and 1,000-V supplies for the intermediate and output stages, respectively, there is no intermediate stage on each of the smaller sets and the output stages are served at 300 V only.

When, finally, we reached the loudspeaker stage of this installation we felt that for the first time we had found something in common, in principle, with the heavier-current installations with which we are more often concerned on our factory visits, namely, that at the actual point of utilisation there is far less opportunity to formulate and conform to standard practices because of local influences. To obtain the best possible distribution and diffusion of sound, suitable types of loudspeakers have to be chosen and placed so as to cope in the best possible way with the factory noise conditions and their bearing on acoustic effects. And what two factories or factory sections have the same characteristics in these respects? Obviously trial and error must play an important part in any scheme and there must be considerable overlapping.



Above: In the confined space of a testing cabin is an industrial "Junior" loudspeaker Left: The æsthetic aspect receives full consideration; cabinets are installed in the offices (note volume control)

In this particular factory there are five different types of loudspeakers in use and we have tried to give guiding principles as to their choice and disposition. In noisy situations the horn-type speaker is given first place in the choice, and so we saw in a press-hammer shop speakers of this type placed as near the machines as practicable. The problem and its solution in this case are crude, and we should say that one speaker per machine would not be "overdoing it."

Where the main problem is to cover a large area the diffuser type of speaker is most suitable. Thus in a shop engaged in machining small parts on light machines and on assembly and inspection work a diffuser unit covers an area of, say, 100 ft. by 100 ft.

A particularly interesting scheme represents a compromise between or a combination of horn and diffuser distribution. It relates to a very large and noisy heavy machine shop—probably 250 ft. long and 120 ft. wide. Along the two end walls are placed horn speakers with about 35 ft. spacings, while roof-suspended at the centre of the shop is a single large diffuser speaker.

For smaller shops the industrial-type of speaker appears to be well suited, especially if they are reasonably quiet. Two models are employed, "Senior" and "Junior," and while reasonable quietness seems to be the governing consideration in the case of the former, very limited space is the deciding factor in the latter case. A fairly quiet shop measuring 40 yd. by 13 yd. and employing about 60 operatives mainly on bench assembly work is served by one centrally disposed, roof-suspended industrial "Senior,"

while in the confined space of a testing cabin where not much volume is required we saw an industrial "Junior." The æsthetic aspect comes in when considering the problem of choice of type of speaker, and so in most of the offices cabinet speakers are to be seen. In the office illustrated the wall-mounted speaker serves about 50 clerks.

Volume control is, of course, of outstanding importance in all cases and has a bearing on both the types of speaker and the local building characteristics. To meet all the volume requirements as far as is practicable, then, there are three progressive systems of control. In the offices each cabinet speaker has its own individual control; in shop or factory sections volume is controlled separately from the individual amplifiers; and by means of the pre-amplifiers in the control desk master volume control is effected for the whole of the main and subsidiary factories.

With the exception of apparatus representing modifications to the initial scheme, for instance, the wooden body of the control desk and the interchange plug and socket board, all the equipment on this installation was produced and supplied by the General Electric Co., Ltd.

South African Notes

From our Cape Town Correspondent

IN his presidential address to the Institution of Certificated Engineers, South Africa, Mr. J. R. W. Saunders, B.Sc., M.Inst.C.E., gave a constructive review of economic tendencies as seen by the engineer. He considered that the South African Railways and Harbours Administration afforded an example of the evils of State ownership. On the other hand, the Electricity Supply Commission was not a political pawn. It was not actually controlled by the State, though in effect a State service. It operated as nearly as possible at neither a profit nor at a loss, and no one could question that it supplied power more cheaply than could any industrial concern. The executive was professionally interested in performing its work efficiently, and the absence of any profit incentive was unimportant.

As in any industrial concern, it was all a matter of engaging a suitable and efficient staff. Its employees had the satisfaction of knowing that they were not being exploited and technical problems were given a concentrated attention rare in industry. Pride of work was given full scope, and most important of all, the whole object of the organisation was to render service to the consumer. If their existing economic system was to survive, this form of organisation provided a model which might well be copied freely.

Automatic Train Control

The ingenious train control instruments which (as reported in the *Electrical Review* of April 9th) are to be introduced over the entire South African Railway system within the next few years, are regarded by the Administration as one of the most important railway electrical engineering achievements of recent times. No details are yet available of the devices, but they are stated to involve a radical departure from the electric train tablet and train staff instruments previously used and will increase the safety of the railways by reducing the risk of human error, expedite traffic schedules and result in an appreciable saving in capital outlay and maintenance. There are at present 20 of the improved instruments in use and as soon as the jigs have been made it will be possible to start mass production at the Electrical Department's central electrical workshops at Langlaagte. The Union network will require about 2,000, the cost of which is estimated to be approximately half that of the complex imported apparatus now used.

The instruments consist of a series of three types: the "absolute," which controls one train between stations at one time; the "permissive," which allows two or more trains to follow at prescribed intervals to the distant station of the section; and the "crossing," which controls two or more opposing trains required to cross at an intermediate point (unattended) in a particular section.

Mr. van Schoor, who has received an award of £5,000 for the invention, was pensioned from the Electrical Department in 1940 but is now supervising the arrangements for mass-producing the instruments and to effect additional improvements.

Domestic Electric Irons

Wholesale electrical merchants in South Africa say that no more electric household irons will be imported from Great Britain and the United States until the end of the war. Attempts are being made to manufacture them in the Union, but the price is high—anything from 37s. 6d. to 45s. each. Nevertheless, there appears to be a fair demand for them.

Electrical Development

Public Utility Boards Proposed

By S. E. Britton, M.I.E.E., M.I.Mech.E.
(Chester Electricity Department)

FROM the inception of public electricity supply the industry and consumers have been "humbugged" with unsuitable legislation, parochialism, private and vested interests, and financiers, and the public have at no time been given the fullest possible service of electricity on the most favourable terms possible. This has been going on since Parliament enacted the first Electric Lighting Act in 1882.

It is amazing that the public have allowed the "humbug" to continue for sixty-one years and the potentialities of the industry to remain in a relatively backward state. There are engineers alive to-day, who, for twenty-five years at least, have tried to bring about improvement and have hoped to see accomplished reorganisation and greater development of the industry as an essential service for all national, business, industrial and domestic purposes, and the application of all moneys and assets arising from the undertakings to remain in the industry to effect further improvements in supply, to lower tariffs and to extend all its practical services throughout the whole of the economic area of supply.

Mr. Britton, one of the pioneers of municipal electricity supply and a past-president of the I.M.E.A., has been prompted to send these notes by our recent series of articles on "Improving Electricity Supply"

It is not the intention to imply that electricity should or need be sold at the lowest possible charge, but rather at the highest possible charge below competitive alternative forms of energy and thus enable the industry to acquire funds for research in new and additional purposes and extensions into undeveloped areas.

Great hopes were centred in the 1919 Act. It did show the mental incompetency of local authorities and small companies to grasp the local and national advantages to be gained by joining together to develop and administer electricity supply on more extensive and comprehensive lines. This encouraged financiers and others to exploit the industry with little regard to the great benefits a more ample supply would give to greater numbers of people over the largest possible area of supply, and it also caused those in Parliament and others who thought well of electricity supply to lose interest.

The changes which are known to be necessary to enable the distribution of electricity to be fully extended throughout the populated area of the country are well known but cannot be achieved until the inconsistent and illogical conditions which exist are removed. The pre-requisite to the expeditious removal of these queer conditions is the formation of a small Public Utility Board charged with power to extend distribution, standardise voltages, unify tariffs, promote sales and generally develop the supply to the limit of its economical practical use for all known purposes for which it is of value, and to carry out research in potential uses and make known the value of all its uses to consumers and to manufacturers of electrical apparatus.

Such a Board should have power to brush aside the objections and disadvantages of local authority, company and other undertakings and be free from the fetters of parochialism and statutory boundaries, in fact, be equipped with powers to promote electricity supply as an essential and vital service for all classes of the community.

Undertakings with experience of supplying electricity over an area governed by more than one local authority know to their cost the futility of continuing with the conglomeration of antiquated local authority organisations comprising parish councils, rural district councils, urban district councils, borough and county councils, and the waste of local and national resources by this worn-out arrangement. It will be criminal neglect if immediately after the war the administrators of national affairs do not make a fresh start in local government and in the supply of electricity and other essential services at the earliest possible date.

Fundamental Considerations

The anomalies in electricity supply are not really great and if the major powers in the country concerned with the development of electricity supply had the will to act with the vigour and ruthlessness which the needs of the country require, the industry would quickly be put on a sound financial, commercial and national footing. There are at least five fundamental conditions connected with electricity supply which are generally known and seldom openly mentioned:

1. No matter how adverse the circumstances, the use of electricity for all purposes advances and will continue to progress.
2. The present extent of electricity supply is primarily due to the boundless inherent benefits of the utility of electricity.

3. No undertaking should be confined to parochial boundaries as such.
4. The pros and cons relating to local authority *versus* company administration are irrelevant and both should be abolished in favour of a small public board or boards.
5. The fullest practical use of electricity has been prevented by unsuitable legislation, statutory bodies, the influence of parochialism and the silent active power of vested interests.

If the electrical requirements throughout the length and breadth of Great Britain were uniform there would appear to be little, if any, reason for more than one public board to deal with the distribution of electricity for the country as a whole. In such circumstances supply could be given at one standard high voltage and one standard low voltage, but as the density of industry and population varies considerably, such a single body or single area does not appear to be desirable or the most appropriate unit for development and administration.

The study of a map of the country showing the location and areas most uniformly occupied by industry and population suggests that distribution areas should vary in size in different parts of the country according to the economics governing distribution, first deciding upon the most suitable standard high and low voltages; and secondly, the largest areas most suitable for the selected high voltage, having regard to geographical conditions and all the activities in the different areas prescribed on the foregoing basis. Such an investigation would probably show that the catchment areas of the most extensive rivers in the country would, apart from the dense and uniform areas of industry and population in the low lands, be a convenient basis upon which to form units of distribution and public boards to administer it.

Great importance has always been attached to the financial difficulty of acquiring undertakings. There is, in fact, no abnormal insuperable difficulty. The time has come for all essential utility services to be administered for the public good and if shareholders have not been compensated for their investments up to date that is no affair of the public. The obvious and just basis for taking over undertakings in the case of local authorities is outstanding debt and for companies' live assets, less adequate depreciation.

Red Cross Appeal

Eighth List

THE Joint Secretaries of the Electrical Industries Red Cross Appeal, 2 Savoy, Hill, W.C.2, have sent us a further list of covenanted subscriptions and donations (the eighth) which we reproduce below:—

Covenanted Subscriptions (gross)

	£	s.	d.
Brought forward	8,691	12	0
Calne Town Council Electricity Supply	50	0	0
Midland Counties Radio Services, Melton Mowbray	10	0	0
Mains Radio Gramophone, Ltd., Bradford	50	0	0
	£8,801	12	0

Donations

	£	s.	d.
Brought forward	5,833	1	0
Leicester Electricity Dept. ..	25	0	0
Sloan Electrical Co., Ltd. ..	26	5	0
	£5,884	6	0

Locomotive Indicators

IN a paper on the counter pressure brake method of testing steam railway engines, which Mr. T. Robson (L.N.E.R.) recently submitted to the Institution of Locomotive Engineers, reference is made to the use, in place of mechanical indicators, of a cathode-ray type.

According to *Modern Transport*, steam pressure within the engine cylinder affects a small stainless steel diaphragm, a porcelain rod being arranged to apply the resulting load to a pressure-sensitive electrical resistance. Consequential variation of the latter causes a proportional change of voltage that is amplified and applied to the cathode-ray tube, thus resulting in vertical displacement on the fluorescent screen on the tube-end, so indicating cylinder pressure. Horizontal displacement corresponding to the piston stroke is obtained by applying a voltage proportional to piston movement.

These two voltages influence the electron beam at right angles so that temperature effects are balanced out when the cathode-ray indicator traces the diagram. Selector switches enable the diagram of any cylinder indicator to be viewed remotely on the electron screen mounted in the dynamometer car hauled by the locomotive being tested.

Microphones and Reproducers

A PAPER on microphones and reproducers was read by Mr. L. C. Pocock at the April meeting in London of the British Institution of Radio Engineers. Commencing with an explanation of the relative merits of volume, peak and total energy (over a period of time) methods of measuring microphone output, the author went on to describe a special instrument having a wide current-handling range for measuring total energy.

Mr. Pocock compared percentage articulation with amplifier capacity, and discussed the characteristics of various patterns of microphones, including highly directional and non-directional types, speaker requirements and conditions for fidelity measurements, including the use of the artificial ear for head receivers. Several very useful tables and graphs and a bibliography were included in the paper.

Reorganisation of Supply

A Suggested Plan for the Future

STUDIED in conjunction with our recent series of articles on the problems facing the electricity supply industry, a pamphlet entitled " The Future of Electricity Supply " by A. M. F. Palmer, A.M.I.E.E. (Fabian Publications, Ltd., 11 Dartmouth Street, London, S.W.1, price 1s.) is of more than usual interest. No one will disagree with the author's hope that after the war the electricity supply industry will have further opportunities for adding to the possibilities of human happiness; nor will there be much criticism of the concise and lucid historic survey of the train of events that has led to the present stage of development of the industry, or of the account of the functions of the various bodies controlling it. But when Mr. Palmer turns to enumerate reasons for interfering with the existing system and to suggest the policy that should be adopted, he is on much more controversial ground, and not nearly so convincing. The statement, for instance, that " if consumers are not getting 'power in abundance at reasonable rates' this is due to the unsatisfactory and confused organisation of electrical distribution " will not by any means be generally accepted.

Nationalisation Proposals

Mr. Palmer has come to the conclusion that there are good reasons for suggesting that complete nationalisation of the industry in the near future is impracticable. After the war Parliament will be faced with the transformation of the whole economic life of the country to a peace basis and will have no time to deal with such " doctrinaire " proposals. Nationalisation, he says, must await the advent of a Parliament in which the " nationalising " party has received a mandate from an electorate whose desires are clear.

From our talks recently with a very large number of engineers and others connected with the industry we very much doubt whether " a majority of engineers and administrators would certainly be in favour of a radical measure of reorganisation." Some measure, yes; but *radical* measure, no.

The author believes that the compensation necessitated by nationalisation might well end by saddling the industry with a heavier burden of financial charges than it bears already. Moreover, distribution does not lend itself easily to stereotyped administration such as nationalisation would inevitably bring. He suggests, rather as the thin end of the wedge, that regional grouping will attain in the end the same goal as nationalisation, namely, a reduction in the price of electricity and an increase in the use by the entire population.

The problem, as Mr. Palmer sees it, is to " rationalise " the distribution of electricity to the ultimate consumer and to make any changes that experience dictates in the existing organisation for generation and transmission, so that the industry can develop under conditions of planned national control. Regional planning, he states, is applicable to most public services, and as a basis for a new Electricity Supply Act he suggests the four following principles:—(1) Grouping of undertakings into larger units, giving the Electricity Commissioners powers to compel amalgamation; (2) selected stations to be owned and operated by the C.E.B.; (3) the creation of a National Planning Authority; and (4) provision for all undertakings to become public property within a stated period of years.

In detailing some of the advantages of grouping undertakings, the author mentions simpler and more efficient planning of the supply system, improved load factor and continuity of supply, greater financial resources for development, the ability to employ more highly skilled specialists, and the lowering of costs of apparatus due to adoption of more standard designs and to central purchasing. Incidentally, the implications of central purchasing are probably not sufficiently appreciated for, among other things, they would almost certainly tend to eliminate the small manufacturer. The suggestion that the transfer of selected stations to the C.E.B. would leave the authorised undertakings free to concentrate upon the new problems in connection with distribution that reorganisation would bring them suggests that transition from one form of administration to another would not be all plain sailing.

The Commissioners' Position

The author admits that the Commissioners, given the powers, *might* answer the purpose of an Electrical Planning Authority, but he thinks that it is preferable that they should continue to function as a judicial body supervising the industry on behalf of Parliament and provide the final link between the supply industry and the community as a whole.

The duties proposed for this Electrical Planning Authority are: (1) To co-ordinate the development plans of the consolidated undertakings and the C.E.B. (which is already done by the C.E.B.); (2) to co-ordinate activities such as design and research " at present lacking a common linking point " (the functions of E.R.A.); (3) to standardise and test apparatus and rationalise the manufacture of apparatus for the home market

(largely the functions of the B.S.I.) and in some circumstances act as a central purchasing agency; and (4) in co-operation with existing organisations (E.D.A. and E.A.W.) do publicity and educational work for the industry. The expenses could, it is suggested, be met by a levy on the industry as a whole, supply and manufacturing.

With regard to his contention that all undertakings should eventually become public property Mr. Palmer rightly points out that the existence of compulsory purchase rights and the anomalies connected with them have slowed down development, and that it would appear logical to argue that if reorganisation takes place the present system of purchase rights should be swept away. But why should "allowing the principle of public purchase to vanish" be a "retrograde step?" and why should "small scale public ownership be preferable in principle to large-scale private monopoly"?

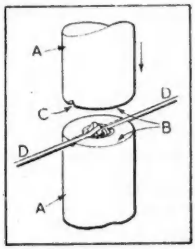
It would seem that the author's preference for public ownership makes him overlook the tremendous amount of pioneering work that the companies have undertaken, with consequent benefits to thousands of consumers, particularly in recent years in rural areas, which they certainly would not otherwise have received.

Mr. Palmer does in fact tend to minimise features and difficulties of reorganisation that do not fit into his plan, and he discounts any schemes that the industry itself might put forward, by remarking that "a reorganisation scheme that satisfied every section of the industry would probably effect no real improvement at all."

Solderless Wire Jointing

RISKS inherent in the joining of copper and other electrical wiring in the traditional manner have always been apparent. The more serious of them may be avoided by the Rakos process recently patented by TECHNOTHERM, LTD., 113, Victoria Street, St. Albans, Herts, for uniting single wires, or one strand to several finer wires, without solder in a way that eliminates the danger of corrosion because a fluxing material is not used.

The process and equipment are simple and manipulation is easy, for the union is effected by means of a device that somewhat resembles a miniature spot welder, which can be operated by a foot pedal or otherwise. This Rakos process, however, is not a true welding operation, since it does not involve arc formation or pressure-contact heating of the junction being made.



Solderless wire-jointing carbon electrodes
A, carbon electrodes. B, butt contact for closing circuit. C, grooved cavity. D, wires to be joined

The wires to be joined, lightly twisted together, are laid in a groove cut in the blunt tip of a carbon electrode. The jointing medium, which may be a fragment of phosphor-bronze scrap, copper, silver, or some other suitable substance, is applied and then another similarly grooved carbon electrode is moved down upon the lower one, simultaneously closing the energising circuit. Butt contact of the electrodes in this way thereupon causes them quickly to become red hot; a temperature of the order of 3,000 deg. C. is generated in the grooved depression within the electrode tips which, in effect, constitutes a tiny furnace enclosure in which union of the wires takes place with minimised risk of oxide growth due to exclusion of air. At the same time any varnish on the wires is burned off without damaging the metal core, so that it does not need to be laboriously removed by hand before the jointing operation.

Joints so made are mechanically more secure than when soldered, their electrical conductivity is good and the actual splicing time is less than with other methods. While the Rakos process may not be universally applicable, it seems capable of removing much tiresome hand work from certain kinds of repetition soldering.

Technotherm, Ltd., does not propose itself to manufacture or distribute the equipment, but will arrange for it to be made by manufacturers with the necessary facilities.

A Frequency Synthesiser

HOW any frequency that is harmonically related to a sub-multiple of a standard frequency can be generated by means of a decade system with a pure output, involving a process of synthesis, is described in a paper prepared by Mr. H. J. Finden (Plessey Co., Ltd.) for the Wireless Section of the Institution of Electrical Engineers.

The adjacent harmonic interference is substantially independent of the order of the harmonic and can be extremely small. The order of the sub-multiple can readily be 1 kc/s and harmonics up to 10^5 of that value can be obtained individually, which means 100,000 frequencies in 1 kc/s steps. When the order of subdivision is too small for the selection of harmonics by tuned circuits, a continuously variable oscillator can be used in conjunction with the normal arrangement. The oscillator can be referred to, or locked from the harmonic series, or can be utilised to compensate for a small known error in the standard.

A four-figure synthesiser uses 24 thermionic valves, but they are of three types only and arranged to mark at low gains to ensure reliability. Except those employed as locked oscillators, all valves are in amplifier circuits and can therefore be replaced without realignment of the circuits. All components are of the mass-produced class, commercially available, thus ensuring interchangeability of spares.

Highlands Water Power

Development Bill Passes Committee Stage

By Our Parliamentary Reporter

AFTER debates lasting for two days, the Hydro-Electric Development (Scotland) Bill has passed its committee stage in the House of Commons. The most interesting change in the Bill on the first day was made at the instance of the Government. Mr. J. S. C. Reid, the Lord Advocate, moved a series of amendments with the intention of protecting the interests of other authorised undertakers against undue competition by the Board to be set up under the Bill. He explained that these amendments would prevent the Electricity Commissioners from permitting the Board to supply authorised undertakers in the area of a power company or large power users in the area of an authorised undertaker unless they were satisfied that the Board could supply appreciably more economically. He said that the authorised undertaker would be entitled to ascertain from the Board the price it was already quoting to a large power user. The Board would then be bound to offer a supply at the same price to another large power user or to an authorised undertaking for transmission to the large power user.

"Novel" Proposals

Sir Arnold Gridley said that in the past the policy had been against allowing a competitor to go into the area of an authorised undertaker to endeavour to secure the right to supply large power users. He declared that the Committee should reflect before it introduced this innovation. Mr. Reid replied that the Government's proposals were novel because of the novelty of the situation. Metallurgical undertakings had to have hydro-electricity or go out of the country altogether.

These amendments were agreed to, as were also others providing that the Board should not be given a monopoly for the production of electricity by steam or processes other than water power, and bringing isolated Highland areas into the first category of priority for electricity supply.

An amendment, moved by Mr. Gallacher, to make the Secretary of State for Scotland responsible for the general control of the Board, was negatived by 221 votes to 77. The Secretary of State explained that he was already responsible for every phase of the Board's activities except the technical side, and he in turn was responsible to the House of Commons.

On the second day the proceedings were much more rapid. Mr. Henderson Stewart strongly criticised Clause 6 (Distribution Schemes). He declared that the present arrangements by which every scheme had to be submitted to the Commissioners was likely to cause delay, and possibly inconvenience and difficulty, for the Secretary of State. The alternative method he submitted and would have pressed had it been in order, was the more sensible and workmanlike method by which the Board was required, in consultation with the Electricity Commissioners, to prepare and present schemes to the Secretary of State for Scotland.

Speaking of the clause in general, he said that it dealt with a simple matter of erecting lines to carry electricity to private consumers. It was not a matter of great transmission lines carrying supplies from the generating stations to the Central Electricity Board. The Government had imposed on the Board here, as they had done throughout the Bill, another cumbrous piece of obstruction. He saw no reason for the system of an inquiry, and why did the Government impose on the Board a condition they did not impose on a private undertaking? It was inconceivable that the Board should be required to do something which was not laid down in the East Anglian Electricity Act, 1927.

Mr. Reid, however, argued that the procedure under the Act of 1927 was more elaborate than that under the Bill, where they had simplified the general law and not expanded it. The general law under the 1919 Act was that a special order for distribution was made by the Electricity Commissioners, confirmed by the Minister of Fuel and Power, and then submitted to Parliament. There was a provision in the code for local inquiries and in certain cases an inquiry was obligatory. But he undertook to look into the Cleveland & District Act, 1928, the East Anglian Act, 1927, and the Wessex Act, 1927 (all of which were suggested by Mr. Henderson Stewart before the debate on the Clause ended). If they suggested any new or better scheme the Government would look into it. The clause was agreed to.

Preservation of Amenities

Mr. Bossom moved an amendment to Clause 8 (Acquisition of Lands) providing that certain restrictions imposed on the use of land should be respected when that land was used for carrying out the Board's electricity schemes.

Mr. Johnston declared that the Govern-

ment had gone to greater lengths for the preservation of the amenities and beauty of the Highlands than had ever before been proposed in any Bill. Mr. Bossom withdrew his amendment.

Commander Galbraith moved an amendment to Clause 10 to the effect that the Board should not supply electricity to large power users within the area of supply of other authorised undertakers at a price less than the price at which the Board would be prepared to supply such authorised undertakers.

Sir Arnold Gridley said that the Board would get the benefit of new business, whether it supplied power direct to new industry or through authorised undertakers. Wherever the supply was to be taken for new industry it ought to be supplied at cost.

Mr. Reid explained that the Government was satisfied that the principle underlying the amendment was fair, and he gave a categorical assurance that the regulations would contain a provision on these lines. The amendment was accordingly withdrawn.

Sir D. K. Murray, Solicitor-General for Scotland, moving another amendment, explained that at present Clause 10 provided that prices were to be determined by the Board from time to time. It was thought in some quarters that this might prevent the Board from entering into a long-term contract, say with a large power user, at a fixed price. He did not share that view, but the amendment would remove all reasonable doubt on the matter. The amendment was agreed to.

Purchase Rights

On Clause 18, which deals with the acquisition of undertakings by agreement, Sir Arnold Gridley moved an amendment to the effect that the powers of the Clause should not be exercisable in respect of the whole or any part of an undertaking which might be purchaseable by any other authorised undertaking under statutory powers. He pointed out that Parliament had already granted to the Grampian Company statutory powers to acquire undertakings within its area of supply. Out of fifteen such undertakings ten had already been purchased. Of the remaining five still not acquired three were already taking their supplies in bulk from that company for local distribution. This clause cut right across legislation already passed by Parliament.

Mr. Johnston said it was true that the Grampian Company had statutory powers to acquire these properties, but Parliament never said that they or any one else should have a monopoly. There were six cases in which authorised undertakers now possessed competitive powers to purchase other undertakings by agreement. There was no intention to interfere with the GrampianCompany's charter or to say that they should not be allowed to purchase these smaller undertakings, but it would be improper for Parliament to bind those undertakings to sell to this company.

This did not satisfy Sir A. Gridley, whose opposition to the clause was supported by Mr. Henderson Stewart, but the amendment was negatived by 141 votes to 11.

An amendment was agreed to, moved by Mr. Johnston, providing that before any negotiations were completed between the Board and any existing undertaker within the Grampian Company's area, the Grampian Company would be informed.

On Clause 19 (Joint Use of Main Transmission Lines) Mr. Reid moved a series of amendments the purpose of which, he explained, was to make the clause "work both ways." At present the clause entitled the Board to make use of the mains belonging to authorised undertakers. It was thought desirable also that there should be power to authorised undertakers to make use of mains belonging to the Board. The amendments were agreed to.

Commander Galbraith moved an amendment, which was accepted by the Government and agreed to, to secure that the owners of a main transmission line, whether the Board or some other producer, should have the use of that line if the full capacity was required.

No "Middlemen's" Profits

Mr. Johnston moved an amendment which, he said, gave effect to a promise made at the second reading, that electricity supplied by the Board to authorised undertakers should be supplied by them in turn to consumers without added profit. The desire was that electricity should be supplied to the Highlands at the lowest possible price, which was the cost price plus cost of transmission. The amendment was agreed to.

On Clause 21 (Application of Electricity Supply Acts to the Board) Sir D. K. Murray moved an amendment, which was agreed to, to secure that any reference to special Acts would apply not only in the Bill when it became an Act, but to the distribution, and construction schemes established under it.

On Clause 22 (Control of New Generating Stations) Mr. Reid explained that, as the Clause stood, there was a prohibition against erecting any new generating station of more than 50 kW unless the consent of the Electricity Commissioners was obtained. The Government had come to the conclusion that there was no reason why the prohibition should be so wide. It was necessary to provide that no one was to jump in in front of the Board and make use of hydro-electric capacity which the Board might ultimately want, but the amendment proposed to take out of the clause all reference to steam or non-hydro stations.

The amendment was agreed to and the Committee stage concluded.

I.E.E. Report

Post-war Planning Activities

THE annual report of the Council of the Institution of Electrical Engineers, presented at the annual general business meeting in London on May 13th, shows that full programmes of technical meetings, which have been well supported with a slightly higher average attendance, have been carried out in London.

During the 1942-43 session there has been a large number of elections, 2,106 of all classes, 3,440 applications for election and transfer having been considered. There are 11,097 corporate members on the register, out of a total of 22,315, which is a net increase of 1,265 for the year. During the last few months three times the normal number of associate members who are qualified for full membership have transferred to the highest class.

Most local centres and sub-centres have successfully maintained their activities; some restricted social functions have taken place and a Wireless Group of the North-Western Centre was inaugurated at Manchester in March. The establishment of groups corresponding to the four specialised Sections is warmly endorsed by the Council as catering for the needs of members who are rarely, if ever, able to attend meetings in London. Other similar groups are expected to be established in the near future and the rules have been suitably modified to provide for this form of activity.

Section Meetings

The average attendance at Wireless Section meetings has increased to 114; efforts are being made to improve and extend its activities. There are to be more informal lectures and more effective collaboration with the American Institute of Radio Engineers. The average attendance at the Measurements Section meetings has been 84; its membership increased by 69 to a total of 879. The Transmission Section attendance has been 89 and its membership is now 1,706. The Installations Section figures are 96 and 1,526. Attendance at informal meetings fell during the second half of the session.

The Council's organisation for post-war planning has been steadily progressing. Many of its sub-committees and panels have produced interim reports on special aspects that have been investigated in detail, aided by summaries of informal discussions in London and at the local Centres as well as reports made by local Centre Committees.

Through the Electrical Engineering Section of the Central Register of the Ministry of Labour 1,408 members have been placed in work of national importance. Entries for state bursaries were about 2,000 in the first year and 1,600 last year. Members on active service with H.M. Forces (2,961) can apply for reduction of their annual subscriptions to half the normal home rate when serving outside Great Britain and Northern Ireland; the membership of both military and civilian members who become prisoners of war is not to be interrupted. Over 650 applications for technical commissions in certain branches of H.M. Forces have been dealt with.

Post-war Buildings

The Electrical Installations (Study) Committee is one of twenty-three specialist committees appointed by the Ministry of Works (Directorate of Post-war Building) to consider the construction and equipment of buildings. Five Study Panels have concerned themselves with various aspects and a first draft report on "Electricity in Small Houses and Flats and in Schools" has been circulated by the directorate to some sixty organisations concerned with post-war building as well as to the Councils of the various electrical bodies represented on the Committee. The Ministry's policy in respect of publication has not yet been formulated. Following the publication of the report of the standing Professional Committee set up under the ægis of the Ministry to direct the preparation of Codes of Practice, the I.E.E. has appointed a special committee for drafting codes relating to electrical engineering work.

Five War Emergency British Standard Specifications were published last year as the result of the work of an I.E.E. committee specially appointed for the purpose and other specifications are being altered. At the request of the I.E.E. the B.S.I. is to commence at an early date the co-ordination of cable identification schemes in order to reconcile differences in colour requirements for cables (I.E.E. Wiring Regulations) and switchgear (B.S.S.).

Education

In collaboration with other institutions a joint panel has been formed of senior engineers willing to deliver lectures to university engineering societies. A total of 428 candidates sat for the associate membership examinations last year. By arrangement with the British Red Cross Society 14 candidates who are prisoners of war in Germany are to sit for that examination in prison camps. Last year 1,369 National Certificates and Diplomas in Electrical Engineering were

awarded in England and Wales (239 courses) besides 84 awards (13 courses) in Scotland; in Northern Ireland there were two courses, the number of awards not having yet been decided.

Accumulated suggestions for alteration of the bye-laws, last revised in 1929, are being examined. The *Students' Journal*, published its fiftieth number this session. The *I.E.E. Journal* is compelled to secure greater economy of paper and authors are to condense their papers still further. A revised eleventh edition of the Regulations for the Electrical Equipment of Buildings will become available almost immediately. The recording of short sound films of honorary members and Faraday medallists, which was suspended in 1936, has been resumed.

The Council records its appreciation of the gift to the I.E.E. by the Hon. Mrs. Leslie Gamage of a portrait in oils of the late Lord Hirst, her father, by Oswald Birley.

Motor Dimensions

Advantages Attaching to Standardisation

A PROPOSAL that British manufacturers should collectively standardise overall and fixing dimensions of commercial motors within the 1- to 50-HP range is made in a short paper by Mr. H. Marryat (Marryat & Place, Ltd.) submitted to the Institution of Electrical Engineers immediately following the annual general meeting in London.

Design within the range of sizes mentioned having approached finality, it is suggested that standardisation cannot be further delayed without prejudice to post-war efforts to secure a wider market. Dimensions which it would be most useful to standardise from the user's point of view are enumerated and commented upon. The advantages to be gained thereby are savings in drawing and erection costs; prompter deliveries; avoidance of delays; fewer spares, requiring less storage space; interchangeability; and ease of replacement of a machine in the event of breakdown.

Manufacturers Not Afraid of Cost

The principal objections that have been advanced against the proposal are answered by the author, who points out that the first cost of re-drawing and re-tooling for even such a limited degree of standardisation as he contemplates will be more than it might appear at first sight. One maker has estimated that it might be £25,000 in his own case and probably £250,000 to the industry. But manufacturers the author has consulted do not regard this cost very seriously, as the opportunity would undoubtedly be utilised to effect improvements when redesigning and the first cost might reasonably be written off in two years.

Disorganisation of production appears to be the most serious of the difficulties to be faced, but the majority of the manufacturing concerns which have been consulted by the author are distinctly in favour of standardisation within the limits of his proposals; some would go much further, even to the standardisation of stampings. So far only recommendations have been made, but no concerted action has been taken. Such delay, in face of what is undoubtedly a general desire, may perhaps be attributed to there being two schools of thought. On the one hand there are designers who consider that dimensions should be tied to output, while on the other hand there are those who deem it sufficient to standardise a series of frame sizes and dimensions, leaving individual manufacturers to obtain what outputs they can from those standard frames.

Latitude in Design

It is not always uneconomic to wind a frame for less output than the maximum possible, for in doing so labour costs are reduced and ventilation is facilitated. American makers have adopted the course of making output correspond with fixed dimensions and it is said that this policy has not proved to be entirely satisfactory, which would seem to imply the advisability of embracing the alternative and so leaving greater latitude in design to the individual manufacturer. So far this country has led the world in motor design, for British manufacturers obtain 15 per cent. greater output per pound of material than their next best competitor (Germany) and 50 per cent. as compared with some others. So, supposing British makers are behind others in agreeing one with another, there is no reason to suppose that when that object is attained they will not still lead the world in design. By virtue of reduced manufacturing costs, they may also be able to compete in price.

While no immediate gain can accrue, if the project is sound the sooner it is initiated the better and, furthermore, most post-war planning schemes must by their nature take still longer to fructify. Energetic action might enable agreement to be reached between the firms concerned in eighteen months; allowing three years for the change-over, the buyer should begin to realise advantages in four and a half years and the export market probably in six years.

Rural System Protection

Four Transmission Section Papers

PROTECTIVE systems for distribution networks in country districts are the subject of four short papers submitted by five authors at a meeting of the Transmission Section of the Institution of Electrical Engineers on Wednesday this week.

Results of Fault Analysis

General principles governing protection up to 33 kV are discussed by Mr. D. C. Field (Wessex Electricity Co.), who emphasises the importance of regarding the prevention of faults as part of the problem equally with their isolation. Analysis of the causes of interruptions, which shows that a large proportion of them are transient, as well as the special conditions pertaining to a rural system, lead to the conclusion that it is preferable to restrict the number of points at which automatic protection is provided in order to facilitate the rapid resumption of supplies.

Protective methods employed in one large rural area are described briefly and a summary is included of experience gained in operating several classes of equipment, such as arc-suppression coils, auto-reclose switches and fusegear in the area of the East Anglian and Wessex companies of the Edmundson group.

L.E.P. Experience

Networks operating at up to 11 kV are dealt with by Mr. Oliver Howarth (Lancashire Electric Power Co.), whose paper is largely descriptive of the nature of the supplies afforded in his company's area and of the testing that is necessary to ensure satisfactory functioning of the protective gear employed. He presents figures to indicate the availability of supplies to consumers during a period of one year, which show that with a duplicate tail-end feeder system simple overload and earth-leakage protection will ensure the minimum of interruption of consumers' supplies provided adequate tests are made to prove the reliability of the gear. When two or more feeders operate in parallel between sending and receiving stations, and provided that the load tapped off along the route does not exceed about 50 per cent. of the normal load of the feeder, very satisfactory discrimination can be obtained with parallel-feeder protective systems.

Typical 11 and 33 kV Scheme

A typical rural scheme which is in operation at 11 kV and 33 kV is described by Messrs. R. W. Steel (Cheltenham Corporation and until recently at Norwich) and A. W. Allwood (Norwich Corporation), who state the reasons leading up to its adoption and emphasise the importance of installing suitable apparatus so that it may be efficiently protective at all stages of network development. Practical difficulties in operation and of carrying out proper maintenance are discussed, while statistical records of interruptions indicate the number and types of faults causing total or partial failures of supply together with the conditions under which the protective gear has to function.

The nature of the faults that occur on rural networks is analysed and a suggested standard form of keeping fault statistics is put forward for general adoption by undertakings distributing in rural areas. Their preparation would thus be simplified, enabling the incidence of faults on different networks to be compared, whereas at present undertakings can only compare one year's operation with another and have no means of gauging whether their standards are good or otherwise. The authors would even go so far as to advocate that the provision of returns relating to extra-high-voltage faults should be obligatory, so that some technical body could undertake their correlation and make the resulting information available to the supply industry in general.

Method Adopted in India

What is believed to be a unique method, described in a paper presented by Mr. J. F. Shipley on behalf of Mr. K. J. Brown (Irrigation Branch, P.W.D., India), has been evolved for the protection of a network of 37,500-V transmission lines against line-to-earth faults, which permits a section of line on which there is a sustained fault to be automatically selected and isolated without utilising earth-fault current for operating protective relays, or pilot wires between sectionalising stations remote from one another.

The scheme, evolved with the co-operation of A.S.E.A. Electric, Ltd., provides for the installation of Petersen coils, together with special auto-selectors and associated equipment, which have been employed with considerable success since 1936 for the protection of a grid system associated with hydro-electric power generation in seven stations on the Ganges Canal. This has been developed from three small independent water power projects with the primary object of transmitting electricity over a wide area in the western districts of the United

Provinces in India, 4,300 miles of overhead lines being now in commission.

Almost complete immunity from circuit outages due to temporary line-to-earth faults has been achieved by the means described, the affected section of line being selected and isolated automatically within 30 seconds of the inception of the fault, without any "kick" being experienced by the power station plant. Existing overload relays continue to protect the system against phase-to-phase faults and, if desired, the original form of earth-leakage protection may be restored by the manipulation of earthing switches. Previously as many as 60 interruptions a month had been recorded on certain sections, over 90 per cent. due to temporary line-to-earth faults of short duration, their origin having been definitely traced to interference by large birds.

If line surges due to switching operations have occurred, their effects have not been observed; transformers, switchgear and line insulators have not been affected thereby.

Interruption of supply to substations connected to "healthy" lines between switching points must of necessity sometimes be experienced, but they will be few.

Education and Training

Recommendations of an I.E.E. Committee

PROGRESS in engineering depends upon personnel. It is therefore essential in the national interest to secure the proper recruitment and training of personnel for the engineering industry, not only for the higher professional ranks but for every grade of worker. It should be a fundamental principle in dealing with engineering personnel to ensure that every individual is so trained that, whatever the work on which he is employed, he can give service in the most efficient manner possible.

These words, taken from the conclusion to the twenty-two page Report on Education and Training for Engineers, which has been issued this week by the Institution of Electrical Engineers, provide the background to the recommendations of the Education and Training and Personnel Sub-Committee of the Post-War Planning Committee (chairman, Mr. J. R. Beard). Dr. A. P. M. Fleming is chairman of the Sub-Committee, the other members of which are Mr. H. J. Allcock, Mr. S. E. Goodall, Dr. H. L. Haslegrave, Mr. D. B. Hoseason, Prof. Willis Jackson and Dr. E. B. Moullin.

Selection of Entrants

Following an outline of pre-war methods comes a discussion of the essential elements of a satisfactory post-war system for training engineers, craftsmen and teachers. The first reference is to the need for a careful selection of entrants. This implies closer collaboration between teachers, juvenile employment officers and industrial representatives, which might take the form of panels for giving advice to prospective students as to courses of study or as to transfer from engineering to careers for which they seem better suited.

A cardinal point of the Report is that those who desire full-time education in colleges should not be kept from it by financial considerations. This implies a development of the State bursary principle. Provision should also be made for increased transfer from National Certificate to university courses. A year should be spent in industry before going from school to university.

Ordinary National Certificate courses are usually restricted to evenings and thus the time available is quite inadequate. National Certificate students might spend alternate periods in industry and in a technical college long enough to gain the Higher National Certificate. In any event, part-time evening classes should be replaced, wholly or partly, by part-time day instruction, leaving evenings free for independent study, under guidance, and to the fostering of other interests.

Two Great Needs

Universities, which afford prolonged education on broad lines, are best able to satisfy two great needs of industry. One is for men capable of interpreting scientific progress in relation to industrial possibilities and of applying scientific methods of analysis to the problems that arise in each stage of technical development. The other is for men who combine, with a good foundation of scientific and technical knowledge, personal qualities and powers of leadership for the productive and administrative sides. The proportion of men destined for highly scientific work is not large and, in most cases, the more advanced stages of mathematics and applied science could with advantage be replaced by other studies, *e.g.*, economics, law and social science.

The university teacher's primary aim must be to awaken the critical faculty of his students so as to enable them to assess evidence and form reasonable judgments. Accumulation of factual knowledge at the undergraduate stage is undesirable. The student is unlikely to retain it; he should,

however, be helped to acquire the habit of seeking such information for himself as the need arises.

Participation in the corporate life of a university is most valuable. If part of the long vacation were spent in works and part of the two shorter vacations were devoted to tutorial classes, preferably individual, instruction during term need not be so intense and more time would be left for the development of wider interests. The electrical industry requires research engineers and these should be university trained largely because of the beneficial effect of the teaching there. The provision of facilities for suitable men engaged in engineering industry to proceed to university schools for one or more years should be extended in view of its benefit to all concerned.

Apprenticeship Scheme

Some scheme of apprenticeship on a national basis for young professional engineers is regarded as essential. The training need not be limited to one company for each individual. It should be supplemented by lectures and discussions dealing with materials and manufacturing processes and with their economic aspects, with the craftsman's outlook and with the organisation of industry.

Following the degree course, the graduate should go in for practical training on the broadest basis and he should then be paid enough to make him self-supporting. After a year he should be able to decide upon the specialised branch of engineering to adopt and, after a further one or two years, to obtain a specific post in his chosen field. Post-advanced courses, *e.g.*, in economics, workshop organisation and industrial management, should be taken by those likely to be able to make use of them.

Organised Manual Training

Manual training should be organised and responsibility for it should be accepted by each employer. It should begin in a special apprentice workshop, which would, wherever possible, form part of the industrial organisation, under the guidance of experienced instructors. In some Continental systems the first two years of apprenticeship are spent in independently operated workshops, equipped with modern machinery, where individual attention and continuity of training can be provided. Small components for the main shops are made and high quality of workmanship rather than speed is insisted on. A second two-year period is spent in various main workshops on commercial production. A scheme on these lines is advocated for this country. It should be combined with classroom instruction and the award of nationally recognised craftsman certificates, sponsored by the Board of Education and possibly by the Ministry of Labour. Where the provision of apprentice workshops is impracticable, the co-operation of the local technical college will be necessary.

As a means of reducing the pronounced decline in numbers of students before the final year of National Certificate courses, a greater use of the cinematograph is suggested for demonstrating elementary principles of mathematics, physics and engineering. Guidance in the profitable use of leisure should form an integral part of an approved course of craft instruction. Part-time day release should be granted for general education as well as for vocational instruction.

Courses for Foremen

Subsequent part-time courses should be provided leading to certification for foremanship. Foremen should, desirably, have received an education of secondary-school standard. The certificate course should include instruction (not now given) in such matters as rate fixing, inspection and store keeping.

Craft and technical training must be founded on sound elementary and secondary education. Support is given to the raising of the school-leaving age. The present system is defective in its methods of selecting and training teachers, who, during training, usually make no contacts outside the scholastic sphere and so are seldom competent to assess the suitability of students for subsequent forms of employment. Teachers might be required to spend two or more years in industry or commerce before acceptance.

Hours of teaching in technical schools should be limited so that teachers may be able to keep in touch with outside progress. Remuneration should be enough to encourage transfer from more senior posts in industry and there should be refresher courses in short vacations or even a return to industry for a year or two. The effectiveness of the university engineering schools would be increased by closer co-operation with industry and members of their staffs should be enabled to take posts in industry for at least one full year in every five.

Women's Part After the War

ADDRESSING a luncheon meeting of the Soroptimist Club of Worcester and Malvern at Worcester last week, Miss Caroline Haslett, director of the Electrical Association for Women, declared that after the war the women of the world would look to the women of Britain for leadership. It would be their duty to lead the world in the use of the many forces, especially electricity, which would become available. There would be so much work for everyone to do that there would be no question of women taking jobs from men.

While in Worcester Miss Haslett also presented E.A.W. Home Workers' Certificates and Badges to eight successful members of the Girls' Training Corps.

PERSONAL and SOCIAL

News of Men and Women of the Industry

AT a meeting of Huddersfield Town Council it was reported that **Mr. E. Lunn,** the borough electrical engineer, would reach the age of sixty-five in December next. It was resolved, subject to the approval of the General Purposes (Wages) Sub-Committee, that as from January 1st, 1944, **Mr. F. A. Ellis,** deputy borough electrical engineer, should be promoted to the position of borough electrical engineer at a salary of £1,300 rising by annual increments of £50 to £1,500 per annum, and that the vacancy thus created in the position of deputy borough electrical engineer should not be filled at present. It was also resolved that **Mr. H. L. Mitchell** should be appointed senior technical assistant at a salary of £600 rising to £700 per annum.

Subject to the approval of the above-mentioned Committee it was decided that Mr. Lunn should be re-engaged in the service of the Electricity Department as from January 1st at a salary of £500 per annum with full responsibility for negotiating with the Central Electricity Board, this appointment to be determinable by six months' notice on either side.

Mr. J. D. Spark, borough electrical engineer of Willesden, became eligible to retire on April 1st and has expressed his desire to do so. The General Purposes Committee has reported to the Council that it is desirable that Mr. Spark's services shall be retained and it has recommended the acceptance of his resignation as from May 1st, 1943, and his re-engagement at a salary which, together with his pension, shall not exceed the scale salary applicable to the original appointment.

Mr. R. P. Sloan, acting on medical advice, has resigned from the boards of Edmundsons Electricity Corporation, Ltd., the Shropshire, Worcestershire and Staffordshire Electric Power Co., the South Wales Electric Power Co., and the B.C. & H. Power Station Co.

Mr. A. G. Connell, electrical engineer and manager of the Halifax Corporation electricity undertaking, has been invited by the Central Electricity Board to serve on the Consultative Technical Committee of the Mid-East England District of the C.E.B.

Chester Electricity Committee has recommended that the arrangement made in 1941, whereby the services of **Mr. S. E. Britton** are retained temporarily as consultant engineer and manager shall be continued. In this issue Mr. Britton expresses some views on the subject of the reorganisation of electricity supply.

At a recent meeting of Leyton Town Council the Electricity Committee reported that consideration had been given to the appointment of a successor to the late Mr. J. Wetherell, as electrical engineer and manager, and that it was proposed to invite applications from members and associate members of the I.E.E. for the appointment at a commencing salary of £1,041. In the meantime it had been decided that **Mr. J. W. Gibbins,** commercial assistant, should be appointed temporary commercial manager, and that **Mr. L. O. Cox,** mains superintendent, and **Mr. A. H. Handscombe,** technical assistant, should be asked to co-operate with him in the conduct of the undertaking.

Mr. F. W. Bissett, works manager, **Mr. F. H. Marchant,** manager, sales department, and **Mr. G. F. Warrell,** secretary, of the Tudor Accumulator Co., Ltd., have been appointed to the board of the company.

Mr. H. M. Rostron, A.M.I.E.E., has been appointed general manager and engineer of the Liverpool Overhead Railway, in succession to Mr. W. L. Box. Since the retirement of Mr. Box, **Mr. J. H. Fowles** has been acting as general manager and engineer, by permission of the Mersey Railway.

Mr. J. V. Werrell, B.Sc. (Eng.), has been nominated as chairman of the North Midland Students' Section of the I.E.E. for the 1943-44 session.

Group Captain C. E. Benson, owing to pressure of duties with the R.A.F., has relinquished the chairmanship of the British Power & Light Corporation, Ltd., and **Sir Robert Hilton,** acting chairman, has been appointed chairman.

The proceeds of a social and dance, held by the staff of Easco Electrical Services, Brixton, S.W., amounting to over £21, have been sent to the Merchant Navy Comforts Service.

Obituary

Mr. C. Stewart, B.Sc., M.I.E.E.—We regret to record the death on May 7th, after a long illness, of Mr. Charles Stewart, who for many years had been associated with Johnson & Phillips, Ltd.

The late Mr. C. Stewart

Mr. Stewart was born at Liverpool in 1878 and was educated at Liverpool College (Upper School) and Liverpool University. From the beginning of his career he was concerned with cable work, his first appointment, in 1898, being with the British Insulated Wire Co., first in the factory and then as outside engineer on cable-laying contracts. He left the company in 1902 to become chief distribution engineer with the Midland Electric Corporation for Power Distribution, Ltd., and two years later joined Johnson & Phillips, Ltd., as contract manager, later becoming sales and contract manager. He was appointed a director of the company in 1922 and was also a member of the boards of the Dunoon, Ringmer and Westmorland electricity supply companies, subsidiaries of Johnson & Phillips. In 1932 he resigned his position as sales manager but retained his directorships.

Will.—Mr. H. W. Kolle, a director of Ferranti, Ltd., and Babcock & Wilcox, Ltd., left £311,093, with net personalty of £305,271.

CORRESPONDENCE

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for correspondents' opinions.

Information on Supply Problems

IN the course of considerable experience in the electricity supply industry it has been increasingly demonstrated to me that there is a need for some regular means of providing for the exchange of information amongst supply engineers, particularly on operating and maintenance problems.

There must have been many occasions when engineers, in seeking fundamental solutions of their own problems, were simply repeating work already done by other engineers. Similarly, many so-called "inadvertent" breakdowns might have been avoided if the records of all similar experiences were generally accessible. What seems to be required is a central clearing house where the full facts of each case, as recorded in detail at the time and before anyone has had the opportunity to theorise, would be available, together with the remedial measures applied and the results obtained ; in other words, a case book of each important event is suggested.

I should be glad to learn the views of other supply engineers on this matter.

Edinburgh. J. ECCLES,
Engineer and Manager,
City Electricity Department.

Organised Maintenance

BY stressing the need for a more organised system of plant maintenance, Mr. H. Greaves has certainly given us something fundamental in what, up to now, has been a haphazard business. In his article in your issue of April 30th he very rightly protests against all maintenance being dependent on crumbs from a tolerant works manager.

Your contributor's courage is to be admired if he has attempted to convince a board of directors of the wisdom of spending money on routine plant inspection. Personally, I would as soon try to convince an audience that a doctor was famous because none of his patients was ever ill. However, this flash of pessimism should not deter the maintenance man from endeavouring to gain recognition. Even the Government realises the value of "back room boys."

From the electrical side, Mr. Greaves' suggestion of a plant maintenance department, embracing all trades, will be treated with a lot of scepticism. Too often to-day, as in the past, electricians come under the jurisdiction of a millwright or other trades chief. The result is that they are considered as merely fellows to mend a fuse or stick a lamp in somewhere. Almost every mechanical defect reveals itself through the medium of the electrical equipment *via* overload or fuses, etc. This being the case the electrical department if not having priority should at least be self-governing. Co-ordination by all means, but let it be directed through a neutral party.

Cheshire. H. WYE.

Alternative Materials

YOU discuss in a leaderette in your issue of May 7th the use of the word "substitute." It may be of interest to refer to the connotation employed in the American plastics industry for aircraft parts : a material is classified according to its mechanical and physical properties as follows :—

(1) A "substitute," where the plastic is inferior to a metal part but gives adequate performance in an emergency. It may be heavier, less durable, or have an unpleasant odour.

(2) An "alternate," where the plastic appears to be equal to a metal or where it is better but more costly or slower in production.

(3) A "replacement," where the plastic is superior to a metal in cost and performance.

These three terms are already recognised and there is much to be said for their use as the meanings are fairly obvious. I enclose the original of my quotation, a report of the May, 1942, meeting of the Society of the Plastics Industry, published as a special insert in the May issue of *Modern Plastics Magazine*, New York.

DENIS L. JOHNSTON,
St. Albans. B.Sc.(Eng.).

Rewinding Armatures

I READ with considerable interest the article by Mr. R. Newing in your issue of April 23rd. His statement that "owing to the present difficulty of and delays in having small motors rewound, this article may be useful to works electricians who are in a position to undertake the rewinding themselves" is surely bad advice these days, for I know of no works electrician who could not be far better employed, because the winding of armatures, particularly those of small and medium dimensions, is a highly specialised operation.

There is very little delay in winding armatures, providing a firm of specialists is consulted and priority clearly stated; two to three days delivery for extremely urgent work is still obtainable.

I have, quite recently, seen the results of

some very futile attempts to rewind high-speed grinder armatures by works electricians and, in one recent instance, by an electrician of a large munition works .

I am in no way criticising Mr. Newing's article which, in the main, is highly informative and instructive and of interest to any electrician. However, I must condemn the antiquated bell and battery method of testing the individual coil circuits. Would not a test lamp be more silently efficient, resulting in far less din and disturbance to other adjacent workers? To how many works electricians would the correct size of wire and covering be available, and the facilities for drying and impregnating armatures?

Mr. Newing's article omitted any reference to what I regard as the most important detail in the rewinding of high-speed armatures, particularly those of grinders, drills and other high-speed machines, *i.e*, balance. A good insulation varnish for high-speed operation is also important.

My advice to all works electricians is most emphatically don't attempt to rewind small armatures, but save time and money by putting this work in the hands of specialists.

In my opinion, a works electrician should be judged by his maintenance record, and his ability to get all power-driven tools and equipment back into production.

Tinkering and unskilled attention has, in my opinion, ruined more electrically operated tools and equipment than the work performed by them has ever done.

*London, S.E.*11. AUTOCAR ELECTRICAL EQUIPMENT CO. LTD.
G. R. FORD, *Managing Director.*

The late Lord Hirst

THERE is one outstanding action in the life of the late Lord Hirst which I have not seen mentioned in the many excellent obituary notices and which I think should not be forgotten in the memory of this great man. I refer to his advocacy and energetic propaganda in the early nineteen-hundreds in favour of the maintenance in this country of works for the manufacture of arc-lamp carbons. At that time this country, and more particularly the Royal Navy, was almost entirely dependent on foreign imports for these vital articles, an alarming state of affairs that his campaign was instrumental in bringing to light.

This action of his was the more praiseworthy in view of his foreign birth, and there can be no doubt that the country of his adoption had good reason to be grateful for his far-sightedness before many years had passed.

Dagenham. A. J. BOUSFIELD.

Better Coal Usage

Large Research Organisation Proposed

COAL utilisation research and the national economy forms the subject of a report just issued by the Parliamentary and Scientific Committee. In this Great Britain's dependence upon coal is stressed, with particular reference to exports, and a warning is sounded regarding the limitations of our coal supplies. It is considered that there are far too few people engaged in research in what is a very vital subject, although it is recognised that very substantial progress has been achieved in the proper utilisation of coal. For instance, it is mentioned that the coal required to produce a unit of electricity has been halved within a generation.

The growth of the electrical industry has created a market of inestimable value for the utilisation of low-grade coal, but boiler plant development is being retarded by difficulties encountered when coal is burned at the high ratings required in "super" power stations. The Committee has been informed that this has proved a serious matter during the war and that steps are being taken by the British Coal Utilisation Research Association, in co-operation with the Central Electricity Board, to promote research to overcome the trouble. It is believed that such research can lower the cost of generation which will greatly help British industry. Similar research will produce important results in the gas industry.

With regard to domestic coal consumption, the Committee urges the simultaneous improvement of equipment for using coal, electricity and gas. Research should be accompanied by a systematic study of the contributions which each can make to domestic heating requirements. This is a matter for co-operation between the industries and this should be fostered by the Ministry of Fuel and Power.

Other matters studied are coal and transport, other fuels derivable from coal, coal preparation, export of coal-using machinery, coal as a source of chemicals, etc. Among the recommendations made for large-scale research, the Committee envisages a complete power station supplying electricity but devoted exclusively to research into electrical generation. It would welcome, too, an investigation into the possibilities of district heating. It is considered that gas and electric cookers can be greatly improved.

The research organisation projected by the Committee would employ several thousands of qualified research workers and the expenditure would run into several million pounds per annum; this expenditure, it is thought, would be amply repaid. The Committee recommends that the industries concerned should be called upon forthwith to submit proposals for the rapid expansion of all the various research organisations.

COMMERCE and INDUSTRY

Pooled Maintenance Scheme. New Associations.

Maintenance Service

LAST July, in the course of an I.E.E. discussion, Mr. H. Marryat suggested that skilled labour was being wasted by the retention of a maintenance staff by each individual works. He said that it was preferable to have a pool scheme for an area and quoted an example in which 100 men in a co-ordinated service were doing work which formerly involved 600. At the same meeting Mr. L. C. Penwill said that the Electrical Contractors' Association was in a strong position to organise such a service.

The Birmingham branch of the E.C.A. has persuaded the local Man Power Board to go into this matter and investigations have shown that eleven out of twenty-seven factories were overstaffed; all but one of the factories were agreeable to their maintenance work being carried out by electrical contractors. The branch is consequently working out a scheme for providing a maintenance service and if this is approved by the Man Power Board it will be put into operation in Birmingham. The Board covers other districts round about that city (Coventry, Wolverhampton, Walsall and the Potteries) and it is suggested that the local E.C.A. branches shall co-operate with the Birmingham branch in extending the scheme to their areas. The Electrical Trades Union is stated to be in favour of the proposals.

Cable Makers' Wages

In accordance with a resolution of the Joint Industrial Council for the Cable Making Industry the full 5s. advance to men is also to be given to those women on men's work who are in the third probationary period laid down by the Substitution Agreement. This payment is to be made retrospective to the first pay-day in April, 1943, in respect of the period for which payment is made on that pay-day.

The J.I.C. has endorsed the view of its Negotiating Committee that the wages contained in the agreements J.I. 510 and 511 are standard (as well as minimum) rates, and that increases may only be paid to individual operatives on account of special ability, long service, or other special circumstances, such special increases in no sense being regarded as setting a new standard rate for any operation either in the works of any individual member, or in the industry. The Committee is of the opinion that the agreements will lose much of their value unless they are applied in the spirit of this resolution and with uniform understanding by all concerned.

Production Control

The British Standards Institution has published the first of a series of booklets dealing with office aid to the factory, with a view to increasing production and saving manpower. The present booklet which is entitled " Principles of Production Control " sets out the advantages which arise from the correct planning of production in factories of all sizes. It points out that bottlenecks and delays in many cases arise from lack of a properly organised production plan which ensures smooth working and the elimination of idle time and duplication of effort. The general principles involved in instituting a system of production control are outlined and the functions which have to be carried out are clearly defined. It is believed that engineering concerns to whom this booklet is particularly addressed should be able to derive considerable assistance from studying it. Copies may be obtained from the British Standards Institution, 28, Victoria Street, S.W.1, price 6d., post free.

Other booklets in the series will deal with the application of production control, stock control and storekeeping, costing, pay-roll methods, and office practice and organisation.

Mica Association

The Mica Trade Association, Ltd., was registered on April 28th as a company limited by guarantee without share capital. The original number of members is 200, each liable for £5 in the event of winding up. The objects of the Association are to promote and protect the interests of the mica trade, etc. The management committee is to consist of ten members (three importers, two brokers and five manufacturers). The first members of the committee are as follows:—D. B. Scott, 45, Leinster Gardens, W.2 (De Clermont & Donner, Ltd.); M. Bergl, 1, Addison Road, Bedford Park, W. (Mica & Micanite Supplies, Ltd.); A. Blackstock (Langley, London, Ltd.); W. E. Bowness (Mica Manufacturing Co., Ltd.); F. W. Copeland (Copeland & Jenkins, Ltd.); C. P. Harrison, 57, Broomfield Avenue, N.13 (Hart Maylard & Co.); W. B. J. Horne, 2, Belvedere Grove, S.W.19 (Hale & Son); W. J. McDonald (Scriven Bros. & Co.); R. F. Mayne (Micanite & Insulators, Ltd.) and Sir Geoffrey L. Winterbotham (F. F. Chrestien & Co., Ltd.). The registered office is at 69, Cannon Street, E.C.4.

I.C. Engine Research Association

The British Internal Combustion Engine Research Association was registered April 27th as a company limited by guarantee without share capital. The word " Limited " is omitted from the title by licence of the Board of Trade. The original number of members is 40, each liable for £5 in the event of winding up. The objects are to promote research in connection with or for the benefit of the internal-combustion engine and allied trades or industries, etc. Members are classified as " ordinary," " associate," " delegate," and " honorary." Only " ordinary " members have voting rights. No foreigner or corporation under foreign control may be admitted to membership without the consent of the Board of Trade.

The first members of the Council are: Ailsa Craig, Ltd.; W. H. Allen, Sons & Co., Ltd.; Atlantic Engine Co., Ltd.; Bamfords, Ltd.; Belliss & Morcom, Ltd.; Blackstone & Co., Ltd.; Peter Brotherhood, Ltd.; Brush Electrical Engineering Co., Ltd.; Coventry Climax

Engines, Ltd.; Crossley Bros., Ltd.; Crossley-Premier Engines, Ltd.; Davey, Paxman & Co., Ltd.; English Electric Co., Ltd.; John Fowler & Co. (Leeds), Ltd.; Gleniffer Engines, Ltd.; R. A. Lister & Co., Ltd.; J. & H. McLaren, Ltd.; Mirrlees, Bickerton & Day, Ltd.; National Gas & Oil Engine Co., Ltd.; F. Perkins, Ltd.; Petters, Ltd.; Robey & Co., Ltd.; John Robson (Shipley), Ltd.; Ruston & Hornsby, Ltd.; Stuart Turner, Ltd.; Tangyes, Ltd.; and the General Electric Co., Ltd. The solicitors are Linklater & Paines, Ltd., E.C.

The Blue Book, 1943

In spite of the difficulties of revision the 61st edition of the Electrical and Engineering Trades Directory ("The Blue Book") is appearing as usual. The necessity for saving paper has led to the suspension of the Geographical Section, leaving the directory in two main sections — the Alphabetical and Classified, which the publishers claim give all the directory information which its many users at present require. Space and paper have been saved by an extensive and radical rearrangement of the headings in the Classified Section, which have been modernised in several respects, where the former descriptions appeared to be redundant or obsolescent. A brief but useful section has been added dealing with the Institution of Electrical Engineers, its purpose, organisation and officers. The publishers are Ernest Benn, Ltd., Bouverie House, London, E.C.4, and the price of the directory is 30s. post free.

Coal Consumption in United States

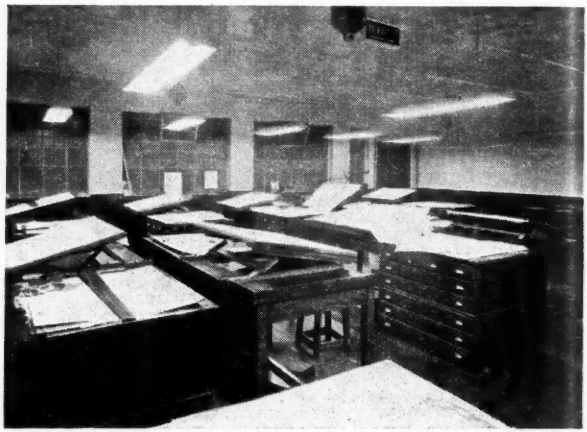
Last year the amount of coal used on the United States railways reached 110 million tons, the *Electrical World* states. The generation of electricity took over 68 million tons and the production of heat for the maintenance of human efficiency accounted for 135 million tons. Production of a ton of steel, it is stated, requires two tons of coal. Smelting of the pig iron alone, 60 million tons in 1942, entailed the coking of 75 million tons of coal.

Prices of Non-Ferrous Metals

The Minister of Supply has made the Control of Non-Ferrous Metals (No. 12) (Copper, Lead and Zinc) Order, 1943, which came into force on May 6th. This Order increases the maximum prices of the red, green and white seal brands of zinc oxide by £3 2s. 6d. per ton in each case, for delivery in lots of not less than 2 tons. The present maximum prices have been in force since December, 1939, but an increase is now necessary to cover the higher costs of production and delivery. Copies of the Order may be obtained from the Stationery Office, price 1d. All inquiries should be addressed to the Non-Ferrous Metals Control, Grand Hotel, Rugby.

Lighting an Engineering Works

The lighting of an engineering works in the north-west has been modernised with "Metrovick" fluorescent lamps, the saving in power and the better distribution of light being well worth the initial expense of the change-over. The high bay in the heavy machine shop is lighted by 400-W fluorescent "iso-thermal" lamps in deep dispersive reflectors while there is a similar arrangement using 125-W fluorescent lamps in the low bay. General lighting has been provided in the erection shop and plate shop with 400-W "iso-thermal" lamps, with two 1,000-W tungsten lamps mounted under the crane in the latter shop. The average working illumination in all the above-named shops is between 11 and 13 ft.-candles. In the light machine shop 400-W and 125-W fluorescent discharge lamps in identical reflectors give a general illumination of 14 ft.-candles and 125-W fluorescent lamps have been installed throughout the shell and whitesmiths' shops to give an illumination level of approximately 12 ft.-candles. Special all-steel inspection hand-lamps each fitted with a 12-V, 6-W lamp supplied from a 150-VA "Metrovick" transformer are provided for local lighting on the work benches in the shell shop. The drawing office is lighted by "Metrovick" 5-ft. fluorescent tubes housed in trough type reflectors to give a uniform high level of illumination on the drawing boards.



"Metrovick" fluorescent tubes in a works drawing office

Aerials Banned in Italy

A new restriction on Italians listening in to foreign broadcasts was announced on May 3rd when it was decreed that all private radio aerials must be dismantled.

Lightning Risks

Safeguarding Steel-Framed and Ferro-Concrete Buildings

RECOMMENDATIONS on how best to protect building structures against lightning recently made by the British Standards Institution, which have been adopted by the Ministry of Works as its first Code of Practice, constitute the first authoritative general guidance that has been made available to the public in this country since the report of the Lightning Rod Conference in 1881 and its amendment by the Lightning Research Committee in 1905.

This Code (BS/CP.1–1943) contains, in addition to recommendations, appendices that consist of comment on some new features, which have been amplified in a paper prepared by Mr. J. F. Shipley for the Installations Section of the I.E.E.

The author attempts to clarify problems connected with safeguarding modern steel-framed and ferro-concrete structures. The effects of electric stress and of lightning on buildings of these kinds are analysed in an endeavour to assess the risk attached to any structure in any part of the world. The zone of protection receives attention; the simple definition chosen for recommendation as a standard is that most parts of ordinary structures, such as a group of buildings, will be safe if lying within a cone having its apex at the top of a well-earthed lightning conductor, the radius of the base circle being equal to the height of the conductor.

Bonding of Metal Pipes

The needs of structures that are very vulnerable to lightning are discussed as is also the presence of metal within buildings, the problem of isolation *versus* bonding being debated. The Code of Practice recommends that all metal sheathing, pipes, etc., entering a building shall be bonded to earth at their points of entry, but it is manifestly impossible to isolate them there owing to the presence, common to all, of the general mass of the earth. What is the object, therefore, of isolating metal within a structure from the protective system, when they are solidly bonded at the earth electrode? The answer is that there may be a minute difference of time between the wave fronts of the voltages growing or declining in the two parallel metal systems which may cause sparkover remote from the earth termination, hence isolation would be effective, but investigation of over 5,828 cases revealed only two instances of discharge to a metal mass.

The steel reinforcement of a concrete building is very troublesome; if electrically continuous it would be an ideal safety cage were it properly earthed without conductors leading into its interior. The effect of the latter can be effectively counteracted by bonding, but the former is difficult to achieve without expensive welding or clamping, since earthing is virtually impossible unless the original designers allow for and the builders provide satisfactory terminals which are accessible for earthing. In the author's opinion, if the reinforcement arrangement and interconnection are unknown, it is safer to apply lightning protection externally.

The components of a protective system, their materials and dimensions, together with their cost, are referred to. There is advice on inspection, testing and the keeping of records; examples of assessment risk in respect of very different types of buildings in various parts of the world and methods of calculating such risk; a statistical summary of claims paid for damage done by lightning with analyses of structures damaged and of the character of flashes causing damage.

Discussion

The discussion on the paper was opened by Dr. E. H. Rayner (N.P.L.), who was associated with the author in drawing up the recommendations. He said that much knowledge and experience had been made available through the one-million-volt apparatus installed in various laboratories here and in other countries. Some twenty Government and other organisations were represented on the Committee, so that a very wide range of experience and knowledge was available. The subject of protection for equipment was referred to the Electrical Research Association, and apparatus for that purpose had been developed in association with the N.P.L. for studying various aspects. Apparatus of this character had been sent out to certain lightning-active regions in other parts of the world and the E.R.A. Committee (of which Dr. Rayner was chairman) expressed its indebtedness to the Metropolitan-Vickers Co. for lending apparatus for this purpose.

Mr. R. C. Price (R. C. Cutting & Co.), a member of the B.S.I. Committee, said he knew of no subject on which there were so many wrong pre-conceived notions. One body had three separate specifications in its own department. It was necessary to be certain that isolation would always exist; extensions of the electrical services would probably affect the original lightning protection.

Mr. E. B. Wedmore (director, E.R.A.) remarked that the advantages and disadvantages of isolation had not been sufficiently

clearly brought out. If conduit was in parallel with a lightning conductor, it might have to carry a very considerable current under the severest conditions and that required careful consideration. Right-angle bends in conduit added to the explosive risk. Again, where there was very little bonding, there was the danger of very high voltages which might not only cause insulation failure but actual short circuits in the wiring, all of which could be avoided if there was isolation instead of earthing. More attention should be paid to the protection of the person than was now the case.

Deeply-sunk Electrodes

Dr. H. G. Taylor (Copper Development Association) agreeing with the author on the question of earthing said that for the protection of power systems rather than, perhaps, for lightning protection, he envisaged the possibility of the use of 1 in. diameter electrodes being driven into the ground by mechanical means to a depth of as much as 100 ft. The risk to persons and animals would be very great near an earthed electrode of a lightning conductor when the discharge was taking place. Bonding was better and more practicable than isolation.

Mr. W. A. Forsythe (an architect) urged architects to pay more attention to lightning conductors and said they should be exposed rather than hidden and that their position should be indicated on a plan of the building.

Mr. F. C. Knowles (Evershed & Vignoles, Ltd.) said that it was necessary to find the best site for the earthing terminal. Wherever possible the earthing electrode should be in virgin soil; made-up soil was very bad and often led to accidents.

Mr. R. Davis (N.P.L.) said that earthed objects had recently been the subject of experimental study at the N.P.L., and that work had been published in the *Journal* of the Institution, although there was no reference to it in the author's bibliography. Metal conductors could be regarded as an inductance in series with a resistance, the greater part of the inductance being in the metal-work, and the resistance in the earth at the bottom. There was very little danger to people if the whole installation was earthed and bonded, but there was the disadvantage that the lightning path might be part of the internal structure of the building. Perhaps bonding was the best solution for the safety of personnel. If separation was considered, it seemed that the services in a building would have to be made to suit the lightning conductor and not the lightning conductor to suit the services.

Mr. J. S. Forrest (C.E.B.) urged the need for an objective method for indicating thunderstorm activity and showed a lantern slide of a block form diagram which he suggested was useful in this connection. He suggested the use of magnetic links for testing important installations and urged that contractors and users should collaborate with a view to obtaining information with regard to lightning currents. Another possible, but more expensive, method was the surge counter, such as was used on lightning arrestors.

Mr. H. M. Lacey (E.R.A.) suggested that in the case of "danger" buildings, provision should be made for the worst that could possibly happen, but for ordinary buildings he did not think bonding was necessary. Technically bonding was the perfect solution, but trouble was likely to arise through imperfect bonds; if a reasonable solution could be obtained by isolation, it seemed a pity to subject the wiring to high voltages.

Mr. P. McKearney (Ministry of Works) considered that the only possible protection for a danger building containing structural steel was complete bonding. Where there was no structural steel, the best method of protection was a mast some little distance away from the building. The best earth termination was a rod driven into the soil, but in certain soils radial tapes were best.

Prof. J. T. MacGregor Morris said that in the case of a certain five-storey building which stood on twelve very heavy steel piers sunk about 16 ft. into the ground he obtained very reliable measurements by the use of battery cells and an ammeter. The values obtained, taking the tests in proper gradation, were under 1/100th of an ohm in clay soil which was moderately wet.

Mr. F. R. Perry (Metropolitan-Vickers) asked for further information of a scientific nature concerning buildings that had been damaged by lightning and said that similar information was also lacking with regard to transmission lines.

American Conditions

Mr. R. H. Golde (E.R.A.), while agreeing that the degree of protection should not be higher than a ratio of 1 : 1, asked why it was that in America four times as much was taken. He thought the reason was that most of the American data were based on lightning strokes which had been observed in New York, where the buildings were very tall. In such cases the normal mechanism of the lightning stroke was reversed. Instead of a flash starting from a cloud it started from the earthed conductor and proceeded towards the cloud, which resulted in an abnormal number of strokes so owing to the greater height of buildings the area to be protected would increase.

Mr. Waring S. Sholl suggested that buildings should have pre-fabricated sills with provision for running the lightning conductors straight down, thus using less copper and avoiding objectionable loops.

The author in a brief reply said a great deal of information had been forthcoming during the course of the discussion and he promised that it would be carefully considered.

ELECTRICITY SUPPLY

Post-war Poplar Station. J.E.A. Proposals Criticised.

Birkenhead. — UNDERGROUND CABLE. — The Electricity Committee is to replace an overhead line by an underground cable at a cost of £1,666.

Bournemouth.—PURCHASE OF UNDERTAKING. —The General Purposes Committee is to ascertain if the Electricity Commissioners will receive a deputation to discuss informally the question of the purchase of the Bournemouth & Poole Electricity Supply Co.'s undertaking.

X-RAY EQUIPMENT.—The Health Committee is to install X-ray plant at the Herbert House Institution at a cost of £1,500.

Cardiff.—MAINS EXTENSIONS.—The Electricity Committee is to extend the mains at a cost of £1,072.

Colchester.—CONTINUOUS METER READINGS.— The Town Council has authorised the introduction on June 1st of a system of continuous reading of meters in place of the present end-of-quarter calls. Accounts and readings controlled through the district offices are not affected. Alderman Owen Ward, chairman of the Electricity Supply Committee, said that the advantages of the scheme were numerous and obvious, and it would result in a saving of man power.

Docking.—OVERHEAD LINES AND AMENITIES. —The Plans Committee of the Rural District Council recommended that temporary approval, expiring a year after the end of the war, should be given to the East Anglian Electric Supply Co., Ltd., to erect poles and an overhead line to a farm. At the Council meeting, however, Mr. C. A. Lewis expressed the view that the company would not proceed with the work on such terms, and he moved that unconditional approval should be granted. He considered that the extension of electricity to isolated districts was of the highest importance. It was indicated that the wording of the resolution, framed in accordance with the town planning officer's advice, was formal and did not necessarily mean that approval would be revoked at a later date, but the chairman (Mr. T. A. Ringer) considered that even so it might put a stop to electrical development. Mrs. Clifton Brown said that the wording was simply to save the amenities and that the Planning Committee, she was sure, was as anxious as the Council to have electricity extended to rural districts. On her suggestion the resolution was referred back to the Committee.

Glasgow.—MAINS EXTENSION.—The Electricity Committee is to extend distributing mains at a cost of £2,434.

Halesowen.—U.V.R. EQUIPMENT.—The North Worcestershire Joint Hospitals Board proposes to install ultra-violet-ray apparatus at Hayley Green Hospital.

Hampshire. — MOBILE GENERATOR. — The County Public Assistance Committee is to provide mobile electric generator plant at the Winchester Institution at an estimated cost of £1,700.

Hull.—WATER-HEATER MAINTENANCE.—The general manager, Mr. D. Bellamy, recently reported to the Electricity Committee that during the current year upwards of 200 consumers would complete a period of ten years' payment of rental for the hire of various types of water heating apparatus, and that as a result the rentals of such apparatus would cease. In consequence, he had arranged a scheme whereby an annual maintenance charge could be paid by the consumers if they so wished to cover repairs.

London. — PROPOSED NEW GENERATING STATION.—Poplar Electricity Committee reports that the scheme prepared by Mr. John Bruce, consulting engineer, for the erection of a new generating station on a site at the East India Docks has been submitted to the Electricity Commissioners and the Central Electricity Board, with a strong recommendation that the site be utilised for post-war development in East London and that one of the selected stations to be erected for the purposes of the Central Electricity Board be established thereon.

INCREASED POWER CHARGES.—Poplar Electricity Committee recommends the following power tariff increases per kWh :—Flat rate, from 1·8d. to 2d.; power supply other than for factories and workshops, from 0·9d. to 1d.; sliding scale for power (factories and workshops), from 1·8d./1·2d. to 2d./1·35d.; and two-part tariff for power (factories and workshops), from 0·72d. to 0·78d. (DC) and from 0·6d. to 0·65d. (AC).

DEARER ELECTRICITY.—The City of London Electric Lighting Co., Ltd., announces an immediate increase in the lighting flat rate from 4½d. to 5⅛ per kWh. The "unit" charge of the two-part rates for power and heating are raised from ¼d. to ½d. Revisions are also made to special contracts, including comprehensive two-part tariff agreements.

MAINS EXTENSION.—Kensington Borough Council is to raise no objection to the proposed extension of an electricity main by the Notting Hill Electric Light Co., Ltd.

OPPOSITION TO J.E.A.'s PROPOSALS.—At last week's meeting of the Hampstead Borough Council the Emergency Committee, in a report on the unification proposals of the London and Home Counties J.E.A., expressed the view that they were unacceptable. The Committee said that, under the scheme, the Council's electricity undertaking, with a total capital outlay of £900,511, would be transferred for the payment of outstanding debts, which were only £46,285. It was not satisfied with this method of treating local authority undertakings nor with the reason given, that it would be unfair to ask the consumers to pay capital charges twice over. It was obvious that consumers in Hampstead would, having paid their own capital charges, be called upon to pay, through the adjusted tariffs, the capital charges of other undertakings with which the undertaking was consolidated. The Committee viewed with some doubt the proposition that a single authority should administer the whole of the area. It added that

charges in Hampstead were now, and had been for ten or fifteen years, among the lowest in the country.

Finchley Borough Council at its last meeting decided to oppose the scheme.

Manchester.—POST-WAR PLANS.—Mr. H. C. Lamb, chief engineer and manager of the Corporation electricity undertaking, has prepared a report on the first steps towards the resumption of normal electrical development. This report has been passed on to the Post-War Reconstruction Sub-Committee.

LOANS.—The Electricity Committee is seeking sanction to borrow sums totalling £29,000 for various purposes.

Salisbury. — OPERATION OF HYDRO-ELECTRIC PLANT.—In the note under this heading in our April 30th issue, we regret that the name of the company was given in error as the Salisbury Electric Light & Supply Co., Ltd. The company concerned is the Downton Electric Light Co., Ltd., whose authorised area covers the parish of Downton, in the Salisbury rural district.

Sheffield.—ELECTRIC OVENS.—Arrangements are being made by the Welfare Committee for the installation of two electric ovens at the Fir Vale Institution.

MAINS EXTENSION. — The Electricity Committee is to extend mains at a cost of £7,951.

Swindon.—SHOWROOMS TO BE CLOSED.—In view of the very limited supply of electrical fittings, etc., now available, the Electricity Committee has decided to close the electricity showrooms.

Wallasey.—SUPPLY TO FARM.—The Electricity Committee has given consent to the Birkenhead Corporation to supply electricity to a farm.

Watford.—NEW SUBSTATIONS.—The Electricity Committee has purchased two substation sites.

Overseas

Canada.—WATER-POWER RESOURCES.——As a result of a complete revision of the figures for British Columbia, the Dominion Water & Power Bureau's latest survey estimates the water-power resources of the country at a substantially higher figure than previously. Under conditions of ordinary minimum flow the total is now given as 25,439,400 HP instead of 20,347,400 HP, and the amount ordinarily available for six months of the year as 39,511,700 HP (previously 33,617,000 HP). As it has proved sound practice to allow a turbine installation 30 per cent. greater than the ordinary six months flow of power this figure corresponds to a potential turbine installation of more than 51,350,000 HP, as compared with the earlier estimate of 43,700,000 HP. The total turbine installation at January 1st this year was 9,225,838 HP (against 8,845,038 HP a year before), equivalent to rather less than 18 per cent. of the turbine HP represented by present recorded water-power resources.

An analysis of the provincial distribution of water power resources (six months flow) and actual turbine installations shows that Quebec leads with resources of 13,064,000 HP and 4,839,543 HP of plant. Whereas British Columbia is second as regards resources, however (10,998,000 HP), the actual turbine installation is only 792,563 HP. The greatest proportionate development is in Ontario, with estimated resources of 6,940,000 HP and a turbine installation of 2,684,395 HP.

Spain.—HYDRO-ELECTRIC DEVELOPMENT.—It is reported from Madrid that Saltos del Duero has applied to the authorities of the province of Zamora for permission to build six reservoirs for power stations on the Rio Tera. The reservoirs will have a capacity of 117 million cu. metres of water, and turbines of about 1,000 kW will be installed at the stations. The S.A. Hidroeléctrica Española has obtained permission to use the Tagus river and tributaries as far as the Portuguese frontier in order to increase its production of electricity. For 1942 the revenue of the company amounted to 60 million pesetas, the net profit being 26 million pesetas. A dividend of 8 per cent. on the ordinary and 4 per cent. on the preference shares will be paid.

TRADE MARK APPLICATIONS

RECENT applications for British trade marks include the following, objections against which may be entered within a month from May 5th:—

HMV. No. 619589, Class 7. Electric washing machines and electric ironing machines. To be associated with No. 618484 (3397) xi and another. No. 618484, Class 11. Refrigerating machines and apparatus and parts thereof (not included in other classes); and electric heating and cooking apparatus. To be associated with No. 622494 (3397) ix and another. No. 622494, Class 9. Electric vacuum cleaning apparatus, electric dust extractors, electric flat irons; parts (not included in other classes) of all the aforementioned goods. To be associated with No. 618484 (3397) xi and another. No. 618483, Class 9. Apparatus, instruments and devices for the recording, reproduction, reception or transmission of sound; television receiving apparatus, electron discharge devices, cinematograph apparatus; and parts (not included in other classes) of all the aforementioned goods; cinematograph films prepared for exhibition.—The Gramophone Co., Ltd., Blyth Road, Hayes, Middlesex.

DYNOMATIC. No. 622135, Class 7. Ignition apparatus for the internal-combustion engines of motor cycles; and lighting dynamos for motor cycles.—Triumph Engineering Co., Ltd., Birmingham Road, Allesley, Coventry.

ASTRA. No. 622232, Class 7. Internal-combustion engines for model aeroplanes; and dynamos and motors (not for land vehicles).—Astra Pharos, Ltd., Landor Works, Landor Walk, Askew Road, Shepherd's Bush, London, W.12.

RILATA. No. 621123, Class 9. Insulated electric wire, insulated electric cables; accumulator boxes, and accumulator jars.—Rubber Improvement, Ltd., Leonex Works, Hythe Road, Willesden, London, N.W.10.

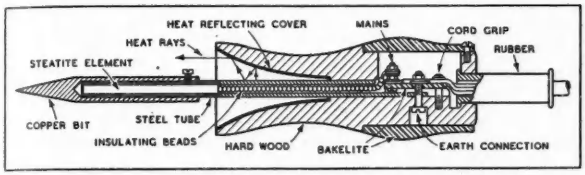
NOTEK. No. 621617, Class 9. Electric apparatus (not included in other classes) for domestic and household purposes.—Notek Electric Co., Ltd., Coastal Chambers, 172, Buckingham Palace Road, London, S.W.1. To be associated with No. 565902 (3027) xiii and others.

RECENT INTRODUCTIONS

Notes on New Electrical and Allied Products

Lightweight Soldering Iron

THE latest pattern of soldering iron to be announced by the ACRU ELECTRIC TOOL MANUFACTURING CO., LTD., 123, Hyde Road, Ardwick, Manchester 12, is the "Pyrobit" model weighing six ounces only, which is specially intended for precision instrument work. It can be handled like a pencil, thereby ensuring better manipulation, which is essential for accurate work.



Lightweight soldering iron for accurate instrument work

The heating element of the iron is insulated with steatite and enclosed in a steel tube that is inserted into a shaped hardwood handle through an open flared end, which is coated internally with heat-reflecting paint. Thus the handle does not tend to become unduly hot in spite of the user's hand being so near the copper bit. The cord-grip and earthing screw at the back-end of the handle are enclosed within a bakelite ferrule.

Electric Riveting Machine

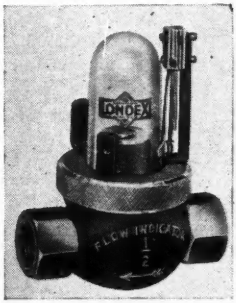
Electro-magnetically actuated light riveting machine

An interesting riveting machine for light work has been developed by BROOKHIRST SWITCHGEAR, LTD., Northgate Works, Chester, which has as its basic principle of operation an electromagnet, making and breaking its own circuit.

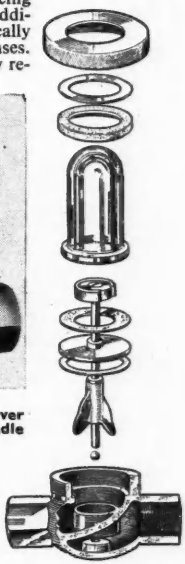
A light blow is given by the riveting arm several hundred times per minute, each blow being of constant weight. The machine is started and stopped by means of a foot - operated push-button switch which leaves the operator's hands quite free to hold and manœuvre the piece to be riveted, as well as economising in power since the machine is "on" only when riveting is being done. This machine has already proved its worth in the production of small parts, and many other similar applications.

Flow Indicator

A remote indicator of liquid flow suitable for cooling and lubricating systems is announced by LONDEX, LTD., 207, Anerley Road, Sydenham, London, S.E.20. The actuating spindle of the transmitter is revolved vertically by a miniature propeller at a speed depending upon the rate of flow of liquid through the pipe. A small permanent magnet carried by the spindle causes electrical leaf-spring contacts mounted externally to the domed glass cover to close a circuit every time the magnetic poles revolve, so energising a relay that makes a signalling lamp glow intermittently, the rate of flicker being an indication of the rate of flow. Provision is made for extinguishing the lamp when the flow of liquid ceases, whether the transmitter contacts remain open or closed. Type "Flow S" outfit is for signalling, incorporating a step-down transformer fitted with an earthed static screen for safety. Type "Flow E" is for use in emergencies, being capable of performing additional functions automatically when flow of liquid ceases. For example, a time-delay relay can be provided to cut out a driving motor in the event of the driven machine failing to receive cooling water or lubricating oil.



Transmitter with outer cover removed and magnetic spindle assembly



FINANCIAL SECTION

Company News. Stock Exchange Activities.

Reports and Dividends

The British Oxygen Co., Ltd.—In the course of his speech at the annual meeting held on May 6th Mr. S. J. L. Hardie (chairman), said that they had promoted the Caledonian Power Bill three times. On the third occasion, in 1937, the Bill was promoted by the company at the special request of the Government, but it was rejected by the House of Commons. The report of the Cooper Committee on hydro-electric development in Scotland issued in 1942 more than justified their promotion of the Caledonian Power Bill. A Government Bill, to carry out to a large extent the recommendations of the Committee was now before Parliament. The foundations of the electro-chemical and electro-metallurgical industries were dependent on cheap and continuous hydro-electric supplies, and it was to be hoped that the North of Scotland Hydro-Electric Board to be set up under the Bill would do everything to establish electric power supplies on a basis which would ensure the introduction of electro-chemical and electro-metallurgical industries, and many other subsidiary industries, in Scotland.

The Brush Electrical Engineering Co., Ltd., reports a trading balance for 1942 of £214,336, as compared with £184,484 for the preceding year, and after charging fees, insurance, depreciation, etc., and taxation, the net profit is £93,130 (against £88,701). The amount written off A.R.P. is £4,572, war damage insurance provision is £4,074, premium on redemption of debenture £9,988 and share issue expenses £9,585. General reserve receives £25,000, and the ordinary dividend for the year is 8 per cent. (against 6 per cent.), leaving £10,271 to be carried forward (against £6,601 brought in).

The Pressed Steel Co., Ltd., reports that after providing for depreciation, obsolescence, deferred repairs, A.R.P. and contingencies, the trading profit for 1942 is £951,673, as compared with £674,928 for 1941, which with interest received and transfer fees makes a total profit of £956,052. After deducting debenture interest, etc., registration expenses and directors' fees and £757,000 taxation on profits for 1942, including income tax payable on January 1st, 1944, the net balance is £179,877 (against £170,615). The final ordinary dividend is 17½ per cent., again making 27½ per cent. for the year, and the balance carried forward is £361,300 (against £310,057 brought in).

Babcock & Wilcox, Ltd., are paying a final dividend of 6 per cent. on the ordinary stock, plus 1 per cent. cash bonus, again making 11 per cent. for the year. The profit for the past year was £623,443, as compared with £616,021 in 1941.

Newman Industries, Ltd., report a profit for 1942 of £67,182, as compared with £63,801 for the preceding year. Taxation, including this year's provision towards tax on current profits, amounts to £33,000. The ordinary dividend for the year is maintained at 20 per cent., general reserve receives £10,000, and the balance carried forward is £16,606 (against £10,044 brought in).

The British Electric Traction Co., Ltd., reports a revenue of £760,293 for 1942-43, as compared with £767,588 in the preceding year. The profit, after providing for taxation, was £569,394 (against £527,393). The final dividends are 5 per cent. on the 6 per cent. cumulative participating stock (making 8 per cent. for the year); 4 per cent. on the 8 per cent. non-cumulative preferred ordinary stock (making 8 per cent.); and 30 per cent. on the deferred ordinary stock (making 45 per cent.). These distributions are the same as for the preceding year. £50,435 is transferred to the undivided profits account.

Hopkinsons, Ltd., state that the profit for the year ended January 31st last was £62,598, after providing for taxation, depreciation, etc., against £55,215. The final ordinary dividend is 12 per cent., raising the distribution for the year from 15 to 17½ per cent. A balance of £92,982 (against £73,260) is carried forward. The report refers to the imminent centenary of the company's business and says that production has steadily increased.

Allen West & Co., Ltd., report a net profit of £50,829 for the year ended January 31 last, after providing for taxation, against £50,195 for 1941-42. It is proposed to place £20,000 (against nil) to staff pension trust fund and to pay a dividend of 7½ per cent. for the year (same), leaving £63,792 (against £69,526) to be carried forward.

The Marconi International Marine Communication Co., Ltd., earned a net profit of £94,477 for 1942, as compared with £96,406 in the preceding year. The dividend is maintained at 7½ per cent. by a final payment of 5 per cent.

The West London & Provincial Electric & General Trust, Ltd., is maintaining the year's dividend at 5½ per cent., by a final payment of 3½ per cent.

The Rawlplug Co., Ltd., has announced the payment of a final ordinary dividend of 30 per cent. again making 40 per cent. for the year.

The Associated Equipment Co., Ltd., is paying an interim dividend of 6d. per £1 unit of stock, free of tax (unchanged).

The West Devon Electric Supply Co., Ltd., has announced a first and final dividend of 5 per cent. (same).

The Bridgwater & District Electric Supply & Traction Co., Ltd., has announced a first and final dividend of 6 per cent. (unchanged).

New Companies

Sign Components, Ltd.—Private company. Registered April 19th. Capital, £1,000. Objects: To carry on the business of manufacturers of, and dealers in, vacuum discharge tubes and lamps, electric lamps, radio valves, electric installations, etc. Subscribers: H. L. Down,

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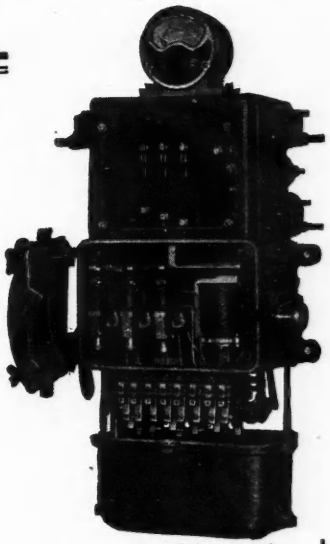

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Melbourne Road, Bushey, Dr. R. Leitersdorf, 3, Caldecote Gardens, Bushey Heath, and J. Jones, 110, Park Avenue, Bushey. Registered office: Friars House, 38-41, New Broad Street, London, E.C.2.

Telefusion, Ltd.—Private company. Registered April 14th. Capital, £100. Objects: To construct and maintain wireless, television, electrical, telephone and cinematograph appliances and accessories, etc. Directors: J. C. Wilkinson, 67, Park Lane, Great Harwood, and F. Nuttall, Oakdene, Rawtenstall. Registered office: 11, Nicholas Street, Burnley.

Heat and Lightcraft, Ltd.—Private company. Registered April 21st. Capital, £100. Objects: To carry on the business of electricians, electrical repairers, dealers in electrical goods, etc. Directors: M. Kenner, 133, Green Lanes, N.16, and M. Levitt, 172, Jubilee Street, E.1. Registered office: 16-17, Devonshire Square, Bishopsgate, E.C.2.

Companies' Returns

Statements of Capital

Highgate Cable & Engineering Co., Ltd.—Capital, £1,000 in 1,000 ordinary shares of £1 each. Return dated December 9th, 1942. 600 shares taken up. £600 paid. Mortgages and charges: Nil.

Mosbrough Electric Supply Co., Ltd.—Capital, £5,000 in 5,000 shares of £1 each. Return dated December 29th, 1942 (filed January 7th 1943). 3,275 shares taken up. £3,275 paid. Mortgages and charges: Nil.

Electro Metals, Ltd.—Capital, £30,000 in 4,000 preference shares of £5 each and 10,000 ordinary shares of £1 each. Return dated December 31st, 1942 (filed January 11th, 1943). 102 preference and 10,000 ordinary shares taken up. £510 paid on preference; £10,000 considered as paid on ordinary. Mortgages and charges: Nil.

Mortgages and Charges

B.C. & H. Power Station Co., Ltd.—Particulars have been filed of £400,000 first mortgage debenture stock authorised by resolutions of June 10th, 1938, June 13th, 1939, November 26th, 1940 and April 5th, 1943, and covered by trust deed dated June 28th, 1938, and supplemental deeds, and ranking *pari passu* with £1,650,000 like stock secured by trust deed dated June 22, 1938, and £850,000 like stock secured by supplemental trust deeds dated June 19th, 1939, and November 26th, 1940. The stock is charged on the company's leasehold and freehold property at Little Barford, Beds; certain easements and rights over lands at Little Barford; certain moneys becoming due to the company by the Central Electricity Board under an agreement; and the company's undertaking, property and assets, including uncalled capital. The whole is now issued. Trustees: Prudentual Assurance Co., Ltd.

Bankruptcies

F. W. Hodges, electrical engineer, 9a, Station Hill, Kidderminster.—Order made April 6th suspending bankrupt's discharge for three months until July 3rd, 1943.

Forthcoming Events

Institution of Electrical Engineers.—*Measurements Section.*—Friday, May 21st, 5.30 p.m. Lecture on "Measurement of Small Quantities," by Dr. E. H. Rayner, M.A.

South Midland Students' Section.—Monday, May 17th, 7 p.m. James Watt Institute, Birmingham. Paper: "Some Applications of Optics to Engineering," by Mr. M. H. Taylor, M.I.Mech.E. (Joint meeting with Graduates' Section of the Institution of Mechanical Engineers.)

North Midland Students' Section.—Saturday, May 22nd, 2.30 p.m. Griffin Hotel, Leeds. Luncheon, annual meeting and film afternoon.

London Students' Section.—Monday, May 24th, 7 p.m. Annual general meeting followed by a film show.

Bristol Students' Section.—Saturday, May 29th, 3.30 p.m. Royal Baths Lounge, Bath. Annual meeting. Films will be shown after the meeting.

Institution of Mechanical Engineers.—Friday, May 14th, 5.30 p.m. Storey's Gate, S.W.1. Informal discussion on "A National Pool for Works Production Councils," to be introduced by Mr. R. E. F. S. Bampton.

Friday, May 21st, 5.30 p.m. Paper: "Surface Finish and the Function of Parts," by Dr. G. Schlesinger.

Electrodepositors' Technical Society.—Monday, May 17th, 5.30 p.m. Northampton Polytechnic, St. John Street, E.C.1. Paper: "Possibilities of Electro-deposition from Non-Aqueous Solutions," by Dr. H. J. T. Ellingham.

Association of Supervising Electrical Engineers.—Tuesday, May 18th, 6.15 p.m. Lighting Service Bureau, 2, Savoy Hill, London, W.C.2. Three winning papers from Branch papers competition.

Institute of Metals.—Wednesday, May 19th, 6 p.m. Institution of Mechanical Engineers, Storey's Gate, London, S.W.1. Thirty-third annual May Lecture by Prof. G. P. Thomson, D.Sc., F.R.S., on "Electron Diffraction." (Applications for tickets should be made to Mr. G. Shaw Scott, M.Sc., 4, Grosvenor Gardens, London, S.W.1, enclosing a stamped and addressed envelope.)

Institute of Fuel.—Thursday, May 20th, 5.30 p.m. Institution of Mechanical Engineers, Storey's Gate, S.W.1. Paper: "Statistics in the Fuel and Power Industries," by Mr. O. W. Roskill.

Birmingham Electric Club.—Monday, May 24th. Paper: "Infra-red Lamp Heating Applied to Paint Drying and other Industrial Processes," by Mr. F. E. Rowland, A.M.I.E.E.

Nottingham Society of Engineers.—Monday, May 24th, 6.30 p.m. Corporation Gas Showrooms, Parliament Street. Paper on "Air Conditioning," by Mr. A. G. Englebach, M.A. (Cantab.).

STOCKS AND SHARES

TUESDAY EVENING.

STOCK Exchange markets are characterised by a good deal of activity, more particularly in stocks and shares of the semi-speculative class. The "Wings for Victory" weeks which are being held in various parts of the country no doubt absorb a large proportion of money which might otherwise be seeking employment in gilt-edged securities. In addition, however, to funds that are floating into the war issues, a certain amount of money is ready to indulge in financial flights that carry an element of chance. Besides all this, investors and speculative investors are closely on the lookout for securities in companies assumed to possess promising prospects in the post-war days.

Home Railway Stocks

Prices in the list of Home Railway prior charge stocks show a tendency to droop, and it is being asked whether the dullness of this department, reflecting as it does a similar condition in British Government and trustee securities, is to be regarded as an indication of decline in the popularity of these particular stocks. Their prices have been held at what looked to be artificial levels for the past two years, maintained, of course, by the cheap money policy of the Government and the closure of the new issue market. Speculative investment is, for the time being, more active than investment itself; maybe people are eschewing the senior stocks in favour of others which offer more scope for capital appreciation, in addition to returning a better yield on the money. Post-war prospects is a phrase with which to conjure nowadays, and it is to this influence that the recent rises in London Transport "C," Southern Railway preferred, and similar issues can be attributed.

Market Movements

After a brief eclipse, the market for radio shares developed renewed strength, under the influence of the demand for A.C. Cossor shares. These have been advanced by 1s.6d. to 22s. 6d., and the rise spread to other shares in the same group. Pye deferred, however, are unchanged at 22s. 6d. E. K. Cole gained 9d., hardening to 21s. 6d., and E.M.I. shares at 24s. 9d. are 1s. up. Marconi Marines improved to 33s. 6d. Hopkinsons are a good market at 61s. 9d., a rise of 4s. 3d. Allen Wests regained the dividend deducted from the price, and put on a further 9d., at 8s. xd. The telephone list is firm. Automatics are better at 60s. 6d. Shares in the companies engaged in the "heavy" industries have been popular. Babcock & Wilcox firmed up to 52s. The manufacturing and equipment section is steady. Johnson & Phillips show no quotable change on maintenance of the 15 per cent. dividend. The 1942 profit figures are good; net profit for the year showed an increase of £5,400; taxation takes £310,000.

Home Electricity

Price changes in this group are again few and insignificant. There is a fairly substantial amount of ordinary stock available, as well as preference shares. Most of the good-class ordinary can now be obtained to give a return of a little over 4 per cent. on the money. Lancashire Electric Light & Power, for example, are available, as to 2,500 shares, at 35s. 3d., paying at that price 4¼ per cent., while 5,000 North-Eastern Electric Supply ordinary can be bought at 32s. 6d., to give about 1s. per cent. more. A fair number of Llanelly & District Electric ordinary came on offer at 26s. at which price the return is £4 12s. 3d. Edmundsons pay about 4½. Midland Counties and County of London ordinary the same, at 39s. in each case. Yorkshire ordinary maintain their price but can be bought at 40s., giving 4 per cent. on the money.

Calcutta Trams

Curiosity was aroused last week by a rise of 3s. 9d. in the price of Calcutta Tramways. The buying which brought about the advance was said, as noted here last week, to emanate from India where, according to rumour, the Calcutta Corporation is about to make an offer for the purchase of the company's undertaking. The directors have now circularised the shareholders reminding them that the Corporation has the right to acquire the undertaking as at the end of December, 1944. The directors state definitely that if the Corporation decides to exercise the right to purchase, there will be provided a sum, divisible amongst the holders of ordinary shares, considerably in excess of the issued ordinary capital, valued at to-day's price on the Stock Exchange. That middle price, it may be added, was 30s.; on the Board's statement, it advanced to 33s. 9d. Calcutta Electrics rose 1s., to 35s. 6d., in sympathy.

Brush Options

Brush Electrical Engineering shares recovered the dividend deducted from the price, and are quoted at 8s. 6d. xd. The options now outstanding confer the right to the holders to take up ordinary stock, at £1 per unit, up to September 30th next. The current units are of 5s. each and at 8s. 6d. per unit, the £1 equivalent is, of course, 34s. The options are quoted at 12s. and thus exercise of the option will cost a buyer 12s. plus 20s., bringing the price roughly into correspondence with to-day's quotation for the 5s. units. The company's profit for 1942 was £118,130

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ELECTRICAL INVESTMENTS

Prices, Dividends and Yields

Company	Dividend Previous	Dividend Last	Middle Price May 11	Rise or Fall	Yield p.c. £ s. d.
Home Electricity Companies					
Bournemouth and Poole	12½	12½	57/6	..	4 6 10
British Power and Light	6	7	31/–	..	4 10 4
City of London ..	7	7	30/–	..	4 13 4
Clyde Valley ..	8	8	39/–	−6d.	4 2 0
County of London	8	8	38/6	+6d.	4 3 2
Edmundson's:					
7% Pref. ..	7	7	34/–	..	4 2 4
Ord.	6	6	29/–	..	4 2 9
Elec.Dis.Yorkshire	9	9	44/6	..	4 1 0
Elec. Fin. and Securities ..	12½	12½	51/–	..	4 18 1
Elec. Supply Corporation ..	10	10	46/6	..	4 6 0
Isle of Thanet ..	2	Nil	16/–	..	—
Lancs. Light and Power ..	7½	7½	35/–	..	4 5 9
Llanelly Elec. ..	5½	6	26/–	..	4 12 4
Lond.Assoc.Electric	4	3	21/–	..	2 17 2
London Electric	6	6	26/6	..	4 10 7
London Power Red. Deb.	5	5	104½	..	4 15 7
Metropolitan E.S.	8	8	38/6	..	4 3 2
Midland Counties	8	8	38/6	..	4 3 2
Mid. Elec. Power	9	9	43/–	..	4 3 9
Newcastle Elec.	7	7	31/–	..	4 10 5
North Eastern Elec. Ordinary ..	7	7	32/–	..	4 7 6
7% Pref. ..	7	7	35/6	..	3 19 0
Northampton ..	10	10	47/6	..	4 4 0
Notting Hill 6% Pref. (£10) ..	6	Nil	9¾	..	—
Northmet Power: Ordinary ..	7	7	37/–	..	3 15 8
6% Pref. ..	6	6	31/6	..	3 16 2
Richmond Elec.	6	6	26/–	..	4 12 4
Scottish Power ..	8	8	38/6	..	4 3 2
Southern Areas	5	5	23/–	..	4 7 0
South London ..	7	7	26/–	..	5 7 8
West Devon ..	5	5	23/6	..	4 5 0
West Glos. ..	4½	3½	23/–	..	3 0 10
Yorkshire Elec.	8	8	40/–	..	4 0 0
Overseas Electricity Companies					
Atlas Elec. ..	Nil	Nil	5/–	+3d.	—
Calcutta Elec. ..	7*	7*	35/6	+1/–	—
Cawnpore Elec.	10	10	30/–	..	6 13 4
East African Power	7	7	32/–	..	4 7 6
Jerusalem Elec.	7	5	25/6	..	3 18 5
Kalgoorlie (10/–)	7½	5	9/–	..	5 11 1
Madras Elec. ..	6*	4*	24/–	..	—
Montreal Power	1½	1½	27½	..	5 7 2
PalestineElec."A"	Nil	4*	39/–	..	2 1 0
Perak Hydro-elec.	6	7	9/–	..	—
Shawinigan Power	83cts.	90cts.	19	..	—
Tokyo Elec. 6%	6	6	19	..	—
VictoriaFallsPower	15	15	4½	..	3 13 0
WhitehallInv.Pref.	—	—	24/–	..	5 0 0

Company	Dividend Previous	Dividend Last	Middle Price May 11	Rise or Fall	Yield p.c. £ s. d.
Public Boards					
Central Electricity:					
1955–60 (Civil Defence) ..	—	3	100	..	3 0 0
1955–75 ..	5	5	115	..	4 7 0
1951–73 ..	4½	4½	109	..	4 2 7
1963–93 ..	3½	3½	103½xd	..	3 7 8
1974–94 ..	3½	3½	101	..	3 3 9
LondonElec.Trans. Ltd.	2½	2½	96½	..	2 11 10
London & Home Counties 1955–75	4½	4½	111	..	4 1 1
Lond.Pass.Trans.:					
A	4½	4½	122½	..	3 13 6
B	5	5	120½	..	4 3 0
C	2⅞	3	63½	..	4 14 7
WestMidlandsJ.E.A. 1948–68 ..	5	5	110	..	4 11 0
Telegraph and Telephone					
Anglo-Am. Tel.:					
Pref.	6	6	113½	..	5 5 9
Def.	1½	1½	28	..	5 7 2
Anglo-Portuguese	8	8	24/6	+6d.	6 10 7
Cable & Wireless:					
5½ Pref. ..	5½	5½	113½	..	4 17 1
Ord.	4	4	81	+1	4 18 9
CanadianMarconi$1	Nil	4cts.	11/–	+3/3	—
Globe Tel. & Tel.:					
Ord.	8½*	5*	35/–	..	2 17 2
Pref.	6	6	29/3	..	4 2 3
GreatNorthernTel.: (£10)	Nil	Nil	23	..	—
Inter. Tel. & Tel.	Nil	Nil	18½	+4	—
Marconi-Marine..	7½	7½	33/6	+6d.	4 9 7
Oriental Tel. Ord.	16	10	37/–	..	—
Telephone Props.	6	Nil	14/–	..	—
Tele. Rentals (5/–)	10	10	11/3	..	4 9 0
Traction and Transport					
Anglo-Arg. Trans.:					
First Pref. (£5)	Nil	Nil	5/–	..	—
4% Inc. ..	Nil	Nil	14	..	—
Brit.Elec.Traction:					
Def. Ord. ...	45	45	1095	+20	4 2 2
Pref. Ord. ..	8	8	170	..	4 14 2
Bristol Trams ..	10	10	51/–	..	3 18 6
Brazil Traction ..	$½	$1	32½	+3½	—
Calcutta Trams	8	5½	33/9	+½	3 5 2
Cape Elec. Trams	5	6	25/–	..	4 16 0
Lancs. Transport	10	10	44/3	+1/–	4 10 4
Mexican Light: 1st Bonds ..	5	5	101½	..	4 18 6
Rio 5% Bonds ..	5	5	104½	..	4 15 9
Southern Rly.:					
5% Prefd. ..	5	5	79½	+½	6 5 7
5% Pref. ..	5	5	117	..	4 5 6
T. Tilling ..	10	10	53/3	..	3 14 5
West Riding ..	10	10	43/–	..	4 13 0

(Continued on next page)

* Dividends are paid free of Income Tax.

Company	Dividend Previous	Dividend Last	Middle Price May 11	Rise or Fall	Yield p.c. £ s. d.
Equipment and Manufacturing					
Aron Elec. Ord...	7½	10	40/–	..	5 0 0
Assoc. Elec.:					
Ord.	10	10	50/–	..	4 0 0
Pref.	8	8	40/–	..	4 0 0
AutomaticTel.&Tel.	12½	12½	60/6	+1/–	4 2 8
Babcock & Wilcox	11	11	52/–	+6d.	4 4 9
British Aluminium	10	10	50/6	+6d.	3 19 2
British Insul. Ord.	20	20	5 7/8	..	3 13 6
British Thermostat (5/–)	18½	18½	17/6	..	5 5 9
BritishVac.Cleaner (5/–)	10	15	24/3	..	3 1 10
Brush Ord. (5/–)	6	8	8/6xd	+5d.	4 14 2
Burco (5/–) ..	15	15	14/3	..	5 5 1
Callender's ..	15	15	82/–	..	3 13 0
ChlorideElec.Storage	15	15	80/–	+9d.	3 15 0
Cole, E. K. (5/–)	7	10	21/6	+9d.	2 6 6
Consolidated Signal	17	24	5 7/16	..	4 8 3
Cossor, A. C. (5/–)	15	10*	22/6	+1/6	3 6 8
Crabtree (10/–) ..	17½	17½	37/6	..	4 13 4
Crompton Parkinson Ord. (5/–) ..	20	20	25/–	..	4 0 0
E.M.I. (10/–) ..	6	6	24/9	+1/–	2 8 6
Elec. Construction	10	10	44/–	..	4 11 0
Enfield Cable Ord.	12½	12½	57/–	..	4 7 9
Elecl. Switchgear (10/–)	10	10	20/–	..	5 0 0
English Electric	10	10	48/–	..	4 3 4
Ensign Lamps(5/–)	25	25	21/3	..	5 17 8
Ericsson Tel. (5/–)	22†	20†	47/6	..	2 2 2
Ever Ready (5/–)	40	40	38/6	..	5 4 0
Falk Stadelmann	7½	7½	30/6	..	4 18 4
Ferranti Pref. ..	7	7	28/9	..	4 17 5
G.E.C.: Pref. ..	6½	6½	34/3	..	3 16 0
,, Ord. ..	17½	17½	89/–	..	3 18 8
Greenwood&Batley	15	15	38/–	..	8 0 0
HallTelephone(10/–)	12½	12½	26/3	..	4 17 0
Henley's (5/–) ..	20	20	25/6	..	3 18 6
4½% Pref. ..	4½	4½	23/–	..	3 18 3
Hopkinsons ..	15	17½	61/9xd	+4/3	5 13 0
India Rubber Pref.	5½	5½	20/–	..	5 10 0
Intl. Combustion	30	30	6½	..	4 17 10
Johnson & Phillips	15	15	69/–	..	4 8 3
LancashireDynamo	20	22½	90/–	..	5 0 0
Laurence,Scott(5/–)	15	12½	12/–	..	5 4 2
London Elec.Wire	7½	7½	31/6	..	4 15 3
Mather & Platt	10	10	50/–	..	4 0 0
Met.Elec.CablePref.	5½	5½	21/3	..	5 2 6
Murex	20	20	5⅝	..	3 14 6
Pye Deferred (5/–)	25	25	22/6	..	5 11 1
Revo (10/–) ..	20	17½	35/6	+6d.	4 18 7
Reyrolle ..	12½	12½	65/9	..	3 16 0
Siemens Ord. ..	7½	7½	30/9	..	4 17 7
Strand Elec. (5/–)	4	7½	6/6	..	5 15 5
Switchgear & Cowans (5/–) ..	10	20	15/6	+6d.	6 9 0
T.C.C. (10/–) ..	5	5	15/–	..	3 6 8
T.C. & M. ..	10	10	47/–	..	4 5 1
TelephoneMfg.(5/–)	9	9	12/–	..	3 15 0
Thorn Elec. (5/–)	20	20	20/9	..	4 16 5
Tube Investments	23⅓	20	94/6	+1/–	4 4 6
Vactric (5/–) ..	Nil	Nil	13/–	..	—
Vickers (10/–) ..	10	10	20/3	..	4 18 9
WalsallConduits(4/–)	55	55	45/6	..	4 16 9
Ward & Goldstone (5/–)	20	20	22/6	..	4 9 0
WestinghouseBrake	10	12½	66/6	..	3 15 2
West, Allen (5/–)	7½	7½	8/–xd	+1/–	4 13 9

* 5 per cent. tax-free.

† Dividends free of Income Tax.

Stocks and Shares (*Continued from page* 666)

(against £88,701 in the previous year). The dividend on the ordinary stock is raised to 8 per cent.

"I.T.T."

An astonishing rise has recently occurred in the price of International Telephone & Telegraph shares. At the beginning of this year the shares were standing at 7. Last week they went up 3½ points to 14½; in the past few days, they have changed hands at 19½. The buying has come from New York and is said to be on behalf of people on the other side who are gambling in any low-priced industrial share that is marketable in Wall Street. On this side, sales are now permitted only to non-residents, subject to certain conditions which are ascertainable at the Bank of England and the Stock Exchange. Canadian utility issues attract no attention, but Hydro-Electrics have spurted to 9. Canadian Marconis came within the ambit of the speculative spirit. The price has risen 3s. 3d. to 11s.

Cable & Wireless

Fresh support has come forward to give a fillip to the market in Cable & Wireless ordinary stock. Some of the buyers paid up to 82, the highest of the present year. They have become surer in their expectation of an increase in the 4 per cent. dividend on the stock, that has been paid of recent years, and there is a ring of confidence in the talk which prophesies 5 per cent. The 5½ per cent. preference stock stands in a different category from that of the ordinary. The yield at the present price of 113½ is £4 17s. per cent.

E.M.I.

Electric & Musical Industries 10s. shares have been fluctuating in correspondence with shares in the radio group. It may be recalled that the company disappointed previous expectations by declaring the same dividend, 6 per cent., as that of a year ago, and the price of the shares came back sharply after touching 26s.

The E.M.I. company holds a controlling interest in Rudge-Whitworth, and reports have recently been current to the effect that the Raleigh Cycle Co. is negotiating for the purchase of the Rudge-Whitworth shares. Upon this, the price of E.M.I. recovered, 1s. to 24s. 9d.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (1s. each) may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2.

ALLMANNA Svenska Elektriska Aktiebolaget.—" Means for the grid control of ionic valves." 2039/42. February 28th, 1941. (552794.)

Automotive Products Co., Ltd., and D. T. Brock.—" Lamps having directional light-restricting screens." 15840. December 8th, 1941. (552698.)

Babcock & Wilcox, Ltd.—" Combustion apparatus for burning solid fuels containing ash." Cognate applications 13465/41, 13466/41 and 13467/41. March 7th, 1941. (552747.)

D. G. E. Beswick.—" Clips for electric cartridge fuses." 14395. November 7th, 1941. (552750.)

British Power Transformer Co., Ltd., and R. C. Henniker.—" Tanks and casings for electric transformers." 1044. January 26th, 1942. (552788.)

British Thomson-Houston Co., Ltd.—" High-frequency apparatus." 10448/41. August 17th, 1940. (552672). "Electric induction apparatus." 15262/41. November 29th, 1940. (552778.)

British Thomson-Houston Co., Ltd. (General Electric Co.).—" Electro-magnetic induction apparatus." 14215. November 4th, 1941. (552690.) " Electric switches, particularly switches for conducting large currents." 15212. November 26th, 1941. (552694.)

British Thomson-Houston Co., Ltd., and W. J. Scott.—" Assembly of electrodes in electron guns for cathode-ray tubes." 1536. February 5th, 1942. (552791.)

Carr Fastener Co., Ltd., and G. Wagstaff.—" Screen caps for thermionic valves." 74. January 2nd, 1942. (552763.)

J. A. Dorrat and Metropolitan-Vickers Electrical Co., Ltd.—" Electric resistance spot-welding." 16111. December 13th, 1941. (552701.)

English Electric Co., Ltd., W. G. Jowett, and E. A. Binney.—" Dynamo-electric machinery." Cognate applications 10586/41 and 3211/42. August 20th, 1941. (552736.)

G. H. S. Grene and Wild-Barfield Electric Furnaces, Ltd.—" Metallurgical processes, and furnaces therefor." 13485. October 20th, 1941. (552748.)

Hasler Akt.—Ges. Werke für Telephonie and Prazisionsmechanik.—" Snap or impulse couplings for magnetos." 1576/42. January 3rd, 1941. (552792.)

C. Holroyd, E. Barraclough and P. A. H. Mossay.—" Compensation of variable-speed AC shunt commutator motors. 8944. July 15th, 1941. (552733.)

Sir H. Ingram.—" Electrical condensers." 9114. July 18th, 1941. (552707.)

D. H. Marlow and British Rola, Ltd.— "Protective covers for apertures for loudspeaking instruments, microphones, and other articles." 11867. September 16th, 1941. (552676.)

R. F. Oxley.—" Electrical couplings and connections." 13320. October 16th, 1941. (552720.)

Philco Radio & Television Corporation.—" Photo-electric phonograph." 13386/41. October 19th, 1940. (552724.)

Philips Lamps, Ltd. (Naamlooze Vennootschap Philips' Gloeilampenfabrieken).— " Circuits for the conversion of saw-tooth voltages into saw-tooth currents." 14067. October 31st, 1941. (552688.) " Arrangements for amplifying or generating electrical oscillations of very high frequency." 15945. December 10th, 1941. (552700.) " Multi-grid electron discharge tubes." 13227. October 14th, 1941. (552718.) " Manufacture of ceramic bodies." 13237. October 14th, 1941. (552719.) " Circuit arrangements comprising a cathode-ray tube." 13232. October 14th, 1941. (552743.) "Exhaust tube constructions in the envelopes of electric-discharge tubes." 15248. November 26th, 1941. (552753.) " Amplifying circuits for ultra-short waves." 15941. December 10th, 1941. (Addition to 552526.) (552760.) " Gas-filled high-tension rectifiers." 16646. December 24th, 1941. (552761.) " Manufacture of plate-shaped ceramic objects." 14789. November 17th, 1941. (552776.) " Devices for the simultaneous tuning of oscillatory circuits having different resonance frequencies." 528. January 13th, 1942. (552785.)

Siemens Bros. & Co., Ltd., D. A. C. Christian and W. H. J. Dibben.—" Telephone systems." 252. January 7th, 1942. (552765.)

Siemens-Schuckert (Great Britain), Ltd., and E. A. J. Tunnicliffe. " X-ray tube holder." 13345. October 16th, 1941. (552721.)

E. C. Steele.—" Electrical connections and the like." 16319. December 18th, 1941. (552781.)

L. Sterling.—" Electrical frequency measuring or discriminating apparatus." 13319/41. October 19th, 1940. (552683.)

C. A. Turner and Diamond H Switches, Ltd.—" Rotary electric switches." 15301. November 27th, 1941. (552755.)

W. West, and W. Geipel, Ltd.—" Regulating switches." 1660. February 7th, 1942. (552793.)

Westinghouse Electric International Co.—" Tensile testing machines." 15699/41. December 5th, 1940. (552696.) " Electric circuit interruptors and arc-extinguishing structures therefor." 13580/41. October 29th, 1940. (552774.)

Opposition to Swiss Project

IT is reported in *The Times* that opposition is growing to a hydro-electric scheme which would involve the demolition of the three villages of Hinterrhein, Nufenen and Medels in order to create an artificial lake. At an open-air meeting the population of the Rheinwald district in the Grisons, north of San Bernardino Pass, unanimously proclaimed their right to remain on their own land and again opposed the scheme.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

Contracts Open

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Abertillery.—May 17th. Electricity Department. Cables, wiring accessories, service materials, meter boards, meters, lamps for public lighting, wood poles, general maintenance material, cookers and spare parts. (April 30th.)

Birkenhead.—May 17th. Electricity Department. Cables, meters and general stores. (April 30th.)

Gateshead.—May 19th. Town Council. Electric lamps. (See this issue.)

Slough.—May 26th. Town Council. Supply and erection of (1) borehole pump (without motor); and (2) horizontal electrically driven pumping set for a duty of 85,000 gal. per hr. against 285 ft. head. Specifications and form of tender from E. Gardner Thorp, waterworks engineer, Town Hall. Tenders to J. H. Warren, town clerk.

Orders Placed

Manchester. — Electricity Committee. Accepted. Static transformers for another twelve months.—Ferranti, Ltd. Reconstruction of existing stokers for boilers, Stuart Street power station.—John Thompson Water Tube Boilers, Ltd. Renewal work to air heaters, etc., Barton power station.—Jas. Howden & Co. (Land), Ltd.

Highways Committee. Accepted. Twin-core and single-core cable.—W. T. Glover & Co., Ltd. Time switches (for traffic signals).—Venner Time Switches, Ltd.

Sheffield.—Electricity Committee. Accepted. Transformers for one year.—Hackbridge Electric Construction Co.

Worcestershire.—Highways Committee. Accepted. Traffic signals at High Street, Evesham (£658).—Siemens & General Electric Railway Signal Co.

Contracts in Prospect

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Aberystwyth.—Additions to University College (£10,000); secretary, Board of Governors.

Bathgate.—Alterations and extensions at creamery (cold storage, etc.); architect, Scottish Co-operative Wholesale Society, Ltd., Morrison Street, Glasgow.

Birkenhead.—Civil defence depot, Woodchurch Road; borough engineer.

Boldon (Co. Durham).—British Restaurant in the Old Town area; U.D.C. surveyor.

Bolton.—Canteen, etc., Hill Mill, Temple Road; H. Crossley (Packings), Ltd.

Canteen; Crosses & Winkworth, Ltd.

Cheltenham.—Depot extension; Red & White Service, Ltd.

Chester.—Office; Chester Engineering Co.

Clutton.—Houses for R.D.C.; A. J. Knott, architect, Bristol.

Consett.—Cleansing station (£759); R. Gallacher, Ltd., Blackhill.

Coventry.—Sewage works; city engineer.

Dodderhill.—Kitchen, etc., Rushwood school (£824); Midland Building Trust, Birmingham.

Durham.—New stores building at Bishop Auckland Institution for the County Council (£1,051); W. Norman, builder, Chester-le-Street.

Further public shelters at Barnard Castle for the County Council; T. Feather & Co., Ltd., builders, Darlington.

Elham.—Housing scheme for R.D.C.; Jackson & Jackson, architects, Ashford, Kent.

Fulwood.—Extensions to Council offices; W. S. Watkinson, surveyor, Council Offices, Garstang Road.

Hendon.—Adaptations (£1,944), Hyde Cottage day nursery, and additional nurseries, Hale and Watling areas; borough engineer, Town Hall, N.W.4.

Lancashire.—Eight additional wartime day nurseries; L. Evans, county architect, County Offices, Preston.

Leeds.—Reception unit at Children's Homes, Street Lane; W. Jones, Director of Public Assistance, 11, South Parade, Leeds, 1.

Littleborough.—Branch libraries at Summit and Smithy Bridge; G. F. Wild, clerk and surveyor, Council Offices, Littleborough, near Rochdale.

Manchester.—Wartime day nurseries at Miles Platting and Newton Heath (£4,720); G. Noel Hill, city architect, Town Hall, Albert Square.

Matlock.—Maternity home; J. Turner, U.D.C. surveyor, Town Hall.

Newcastle-under-Lyme.—Maternity hospital; A. Cotton, borough surveyor, Municipal Offices, Lancaster Buildings.

Nottinghamshire. — Shelters and A.R.P. premises (£16,000); county architect.

Peebles.—Proposed hospital and nursing home; superintendent, Morelands War Memorial Hospital, Peebles.

Sheffield.—Alterations to Dryden Block, Fir Vale Institution, with electrical equipment; W. G. Davies, city architect, Town Hall.

Shipley.—Control room, Wrose Brow Road; Lee & Crabtree, Ltd.

Stockport. — Works extensions; G. W. Marsden, agent and merchant, Union Bank Chambers, Bridge Street.

Surrey.—Junior school, Kingston Vale, Malden, and additional school canteens; county architect, County Hall, Kingston-on-Thames.

Welland.—Remand home (£2,458); A. C. Billings & Sons, Ltd., Cheltenham.

York.—Offices and garage, Cemetery Road; J. T. Wailes & Son.